Kawartha Lake Stewards Association

2021 Annual Lake Water Quality Report

Lake Stewardship in Action

MAY 2022

LAKE STEWARDSHIP IN ACTION

This report was prepared exclusively for the members of the KLSA, its funders, interested academics and researchers, and other non-profit associations and individuals engaged in similar water quality testing in Ontario. The accuracy of the information and the conclusions in this report are subject to risks and uncertainties including but not limited to errors in sampling methodology, testing, reporting and statistics. KLSA does not guarantee the reliability or completeness of the data published in this report. Nothing in this report should be taken as an assurance that any part of any particular body of water has any particular water quality characteristics, or is (or is not) safe for swimming or drinking. There can be no assurance that conditions that prevailed at the time and place that any given testing result was obtained will continue into the future, or that trends suggested in this report will continue.

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To obtain copies of our report or to find out more about KLSA, please contact:

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You can view Adobe pdf versions of KLSA reports on the KLSA website: **klsa.wordpress.com.**

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Editorial Committee:

Chair: Sheila Gordon-Dillane
Members: Tom McAllister, Jacqui Milne, Kimberly Ong and Carol Cole

Cover photo: Juvenile Midland Painted Turtle* soaking up the sun on Stoney Lake.
Photo credit: Ann Gronow, Volunteer, Ontario Turtle Conservation Centre, Peterborough

*The Midland painted turtle is a species of *Special Concern* listed by COSEWIC and SARA. It is another species greatly impacted by the loss of more than 70% of Ontario's wetlands.

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Chair's Message

Ed Leerdam
KLSA Chair

It's March as I write this message to you - our members, volunteers, supporters, partners and collaborators, lake and cottage associations, and other users of this report. After two long years of pandemic scares, restrictions and economic uncertainty, it appears we are finally coming out of the worst of it. Sadly, after enjoying a few weeks with a somewhat unified world participating in the Beijing Olympics, war has broken out in eastern Europe. While all of this has been going on, climate change has not been dormant - with extreme climate events affecting regions around the globe, including the recent flooding in British Columbia and now in Australia.

The Kawartha Lake Stewards Association is a group of volunteers, made up of residents, cottagers and businesses in the Kawarthas, concerned about the quality of the water in our lakes and rivers and the general health of these waterways. In the pursuit of its mission, KLSA often collaborates with other like-minded organizations, universities and colleges, academics and researchers, conservation authorities, government ministries and non-governmental organizations.

Following some pandemic-related disruptions in 2020, KLSA and its volunteers were largely able to return to 'normal operations' in 2021 in terms of water sampling and our other programs. Now, after a 'real Canadian winter' in the Kawarthas with temperatures dropping into the minus 30s combined with abundant snowfalls, no doubt we are all looking forward to a 'normal' summer. As of this writing, we are hopeful that we can have our annual 2022 spring public meeting in person. We have really missed these events where we can meet and greet you face to face to discuss your issues and concerns about your lake. Watch for our emails, Facebook posts and announcements on our website. There will be the opportunity to attend virtually as well.

Throughout its 21 year history, KLSA has not only provided public education and supported advocacy initiatives to protect and improve the quality of the Kawartha Lakes, but has also been actively involved in programs to improve lake water quality. With this in mind, the theme of this year's Lake Water Quality Report is **Lake Stewardship in Action**. KLSA stewardship initiatives, also known as community science, take many forms. These range from collecting water and aquatic plant samples for analysis to documenting environmental components sensitive to climate change to analysis of the performance of sewage treatment plants to assisting cottagers and permanent residents to renaturalize their shorelines by planting native species of flowers and shrubs. Our annual reports, public meetings and website provide opportunities for the sharing of information and development of long-term databases.

This year's report highlights a number of these projects and programs, offered either by KLSA alone or in collaboration with other like-minded organizations and implemented primarily by volunteers. I hope you enjoy reading about them. If so, and you would like to get more directly involved, there are many opportunities for people to participate. We welcome anyone interested in our association and our programs to email KLSA at klsa@klsa.info for more information.

One of the biggest concerns raised by members of the KLSA community is what appears to them to be a substantial increase in 'weeds in the lake' (or what our aquatic biologists refer to as 'aquatic plants'). Top of the list are two invasive plants: Eurasian Water Milfoil (EWM) and starry stonewort (SSW). EWM has been around for a very long time and has established itself throughout the Kawarthas. The newer SSW spreads much more rapidly than EWM, and has a greater impact on fish habitats and on the ability to enjoy watersports and boating. KLSA volunteers are running a program to look for and report sightings of SSW in this region in order to inform possible remediation strategies.

Many people enquire about how to 'get rid of the weeds'. While there are tactical options for weed removal (e.g., weed harvesting, herbicides, etc.), it is important to keep in mind the two main contributors to the proliferation of aquatic plants. These are:

1) Phosphorus – A major contributor is fertilizer runoff from agriculture as well as lawns on shorelines, especially where shorelines are developed right to the water's edge. A natural shoreline (see article about the Natural Edge Program) and reduced use of fertilizer will reduce phosphorus in our lakes.

2) Boats being moved between lakes - The practice of cleaning off, draining and drying your boat after it is

Chair's Message

taken out of the water will help reduce the spread of aquatic plants from one lake to another. Please note that as of January 2022, this practice is now a regulation under the provincial Invading Species Act. (See Fighting Aquatic Invasive Species in the Kawarthas and Beyond in this report.)

Another aquatic plant about which KLSA receives questions is manoomin/wild rice. This plant is actually an indigenous species to this region. While not nearly as widespread as EWM or SSW, it is spreading as a result of both natural processes and seeding. Harvesting manoomin is a long-held cultural tradition of First Nations to provide food for their tables. While many who enjoy watersports and boating may be affected by the spread of this aquatic plant, it is neither an invasive species nor harmful to our waters and fish. If you are interested in learning more about the many questions on this topic, you might wish to watch the CBC documentary at https://youtu.be/p9k42UkDvxc. This is a complex issue to which there is no simple solution. It is our belief however that reasonable, well-meaning people can almost always come to an understanding.

If it weren't for volunteers, KLSA would not exist. We are very fortunate to have so many wonderful and dedicated volunteers who collect water samples and take them to the lab, participate in our many programs, serve as advisors, contribute articles for this report or serve on its editorial committee, serve on our Board, or support us financially and in so many other ways. As you can see, the list goes on and on. Thank you to all of you!

Changes in the KLSA Board during 2021:

• Tracy Logan joined the Board in 2016 and resigned in early 2021. During her time on the KLSA Board, Tracy helped to maintain the membership lists and was involved in community outreach. Tracy remains busy with her family with young children, running the family business, and involvement in the Kawartha Chamber of Commerce.

• Bill Napier joined the KLSA Board in 2015, and served as Chair from 2015 to 2020. Bill resigned from the Board in early 2021. While on the Board and serving as Chair, among the many things Bill did for KLSA, he spearheaded a major paleolimnology study which provided important context for understanding the effects of climate change on the Kawartha lakes region, instituted KLSA's climate change monitoring program, and laid the groundwork for KLSA's participation in the Natural Edge shoreline restoration program.

• Anna Currier, who joined the Board at our 2020 AGM, has moved on to a new position with Toronto and Region Conservation Authority in July 2021, and with that has relocated out of the Kawarthas. In her short time on the KLSA Board, Anna assisted us in our community outreach initiatives.

• Kimberly Ong joined the Board early in 2021. Kim is no stranger to KLSA's work as for some years she has been part of the editorial committee which produces this annual report. Kim immediately took over the Natural Edge (shoreline naturalization) Program, and in 2021, with the help of volunteers, and in collaboration with the Environment Council (Clear, Ston(e)y and White Lakes), led efforts to restore 11 privately owned shoreline properties in the Kawarthas.

• Jacqui Milne joined the Board in October 2021, shortly after our AGM, and brings a wealth of experience to the KLSA. Jacqui is currently working as a Physical Scientist at Environment and Climate Change Canada, working on aquatic ecology. Jacqui and her family have lived in the Kawarthas for many years and have a keen interest in the quality of our local lakes.

Please continue to visit our website and Facebook Page (and share and like) as we continue to post information on our activities and programs throughout the year.

Email: klsa@klsa.info

Facebook: Kawartha Lake Stewards Association

Website: https://klsa.wordpress.com/

YouTube: Kawartha Lake Stewards Association

Our KLSA Lakes - A Living List

Robert Bailey
KLSA Director

Ever since the Kawartha Lake Stewards Association was established more than 20 years ago, there have been frequent discussions and questions about our 'boundaries'. What ***is*** or ***isn't*** a 'Kawartha Lake'? Lakes obviously aren't defined by political boundaries, so we can't define KLSA lakes by their municipalities or counties. Conservation Authorities in Ontario often use ***watersheds***, the land area draining into a particular lake or river outflow, to define their boundaries. But even this doesn't really work for the KLSA, as the actual watershed for many of our lakes extends well beyond our area of interest. Aquatic scientists sometimes speak of a lake's ***socioeconomic shed***, the land area where human activity (e.g., at public boat launches) affects a lake ecosystem. Over the last century or so there have been a few versions of this kind of definition of the Kawartha Lakes, usually associated with tourist information. It's obvious that defining the KLSA's boundaries is more complicated than it seems.

After plenty of recent discussion both within and beyond the KLSA Board, we decided to adopt an inclusive approach to defining "our" lakes. We found the following categorization of our lakes useful. We don't mean to imply a ranking of importance in our programming or interest…the categories just reflect what we think is a helpful organization of the lakes in our area.

• **TSW lakes** - lakes on the Trent-Severn Waterway (TSW) between Mitchell Lake and Katchewanooka Lake inclusive and where KLSA has existing or potential program partnerships

• **Feeder lakes** - lakes that significantly influence TSW Lakes and where KLSA has existing or potential program partnerships

• **Associate lakes** - lakes near TSW and feeder lakes where KLSA has existing or potential program partnerships

TSW lakes

- Mitchell Lake
- Balsam Lake
- Cameron Lake
- Sturgeon Lake
- Pigeon Lake
- Buckhorn Lake
- Lower Buckhorn Lake
- Lovesick Lake
- Stony Lake
- Clear Lake
- Katchewanooka Lake

Feeder lakes

- Shadow Lake (north of Balsam Lake)
- Silver Lake (north of Balsam Lake)
- Four Mile Lake (northeast of Balsam Lake)
- Lake Scugog (south of Sturgeon Lake)
- Emily Lake (southeast of Sturgeon Lake)
- Little Bald Lake (northeast of Pigeon Lake)
- Big Bald Lake (northeast of Pigeon Lake)
- Sandy Lake (north of Buckhorn Lake)
- Chemong Lake (east of Buckhorn Lake)
- Mississagua Lake (north of Lower Buckhorn Lake)
- Upper Stoney Lake (north of Stony Lake)

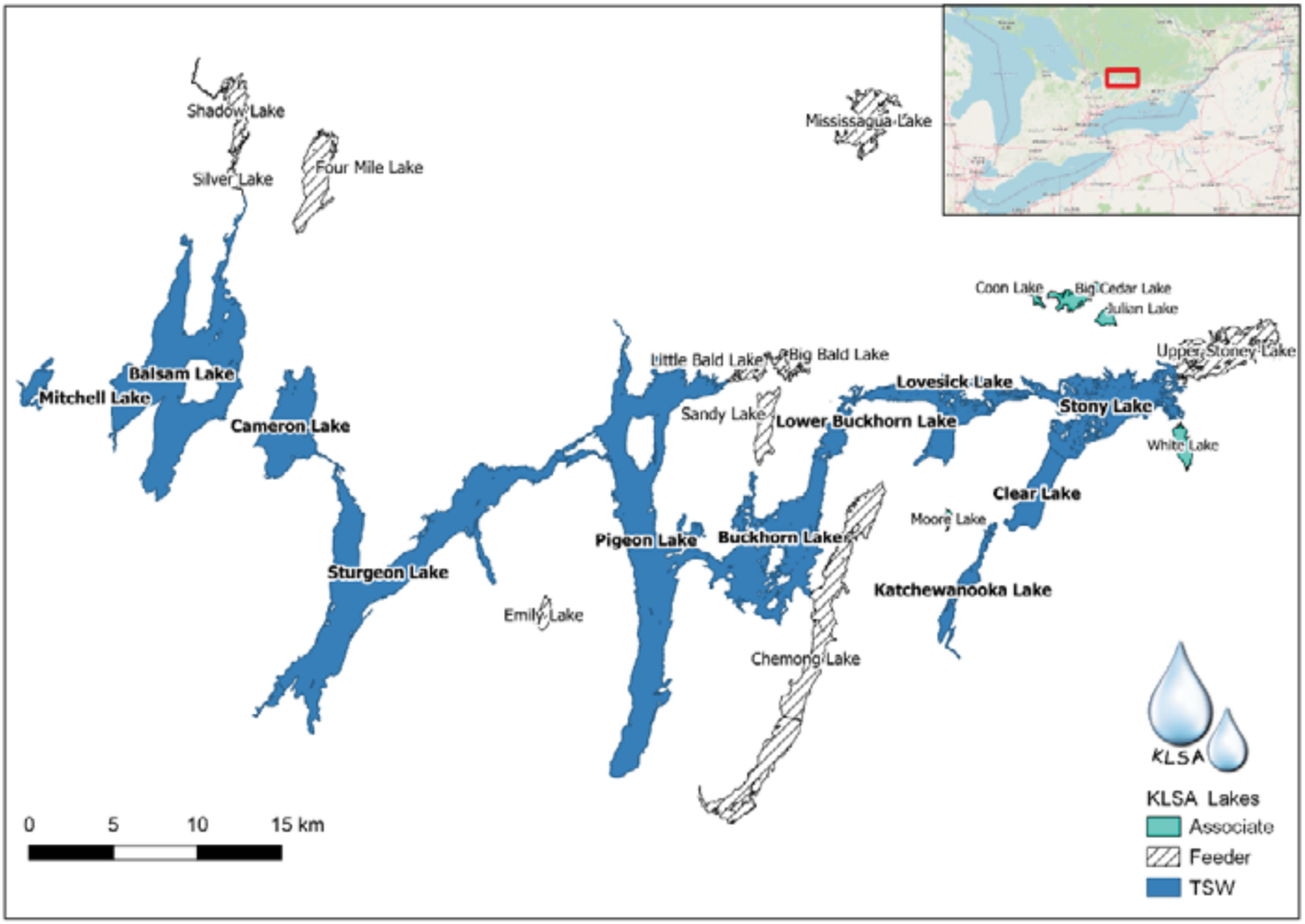
Associate lakes

- Moore Lake (south of Lower Buckhorn Lake)
- White Lake (south of Stony Lake)
- Coon Lake (north of Stony Lake)
- Big Cedar Lake (north of Stony Lake)
- Julian Lake (north of Stony Lake)

This is a living list, so if you don't see a lake that you think should be here, please let us know. Our mission is to serve our members!

Our KLSA Lakes - A Living List

Map of Kawartha Lake Stewards Association lakes



Note – Lake Scugog, south of Sturgeon Lake, not shown.

KLSA Photography Contest

This year, the Editorial Committee held a photo contest for the cover of our 2021 Annual Lake Water Quality Report. Eighteen photographs were submitted by nine talented photographers, including pictures of scenic reflections, sunsets, wildlife and trees. The Committee was very impressed with the quality of the photos and it was a difficult decision to choose the one for the cover. Congratulations to Ann Gronow for her picture of a turtle basking in the sun on Stoney Lake, the winner of the contest. A close second and third were photos of a heron and a loon, both by Rachelle Mack (see page 10). The Editorial Committee decided that all the photos were worthy of honourable mention so they are included throughout the report. Thank you to all of the participants in the contest. We will likely make this an annual event so plan to participate next year.

Lake Management Plan Implementation: A Three-Year Summary

Ian McRae, *Environmental Communications Kawartha Conservation*

Since 1979, Kawartha Conservation has been the recognized leader of natural resource management in the Kawartha Lakes, focusing on protecting, restoring, and maintaining the beautiful landscape and ecosystems that many plants, animals, and people call home.

The proper management of this region's resources requires thoughtful planning, collaboration, and execution. The goal of a healthy, beautiful, and sustainable Kawartha Lakes is shared by Kawartha Conservation, the City of Kawartha Lakes, the Township of Scugog and many other organizations and partners throughout the watershed.

A lake management plan (LMP) provides a framework for establishing goals, objectives, and direction for the management of human activities, land, water, aquatic life, and protection of resources within the watershed. It includes recommendations and actionable items that are similar in purpose, but specific in addressing the needs and pressures of each unique lake ecosystem.

Kawartha Conservation has completed eight LMPs including Balsam and Cameron Lakes, Canal and Mitchell Lakes, Four Mile Lake, Head Lake, Lake Scugog, Pigeon Lake, Shadow Lake, and Sturgeon Lake, with the ninth – Lake Dalrymple – currently in its second of a four-year planning process. These plans are carried out through the Implementation Action Plan. This five-year strategy was created in partnership with members of the lake communities, municipal leadership and Kawartha Conservation starting in 2019. Two main programs were developed to ensure that common high priority actions from the LMPs were addressed (fig. 1).

The **Incentive Grant Program** provides funding to allow community groups and private landowners to deliver projects and implement best management practices (BMPs) that positively impact the health of our watershed. Funding for these grants is provided by municipal partners, such as the City of Kawartha Lakes and Township of Scugog, and administered by Kawartha Conservation.

Throughout the past three years, Kawartha Conservation has seen remarkable progress in the implementation of the LMPs facilitated through the Incentive Grant Program. Since 2019, stewardship projects have soared, with hundreds of thousands of dollars leveraged in community and landowner investment and dozens of projects completed in 2021 alone.

From 2019 to 2021, the City of Kawartha Lakes invested a total of $121,800 into projects leveraging

		Urban/Rural					Rural							
Recommendation	Strategy	Balsam/Cameron	Canal/Mitchell	Scugog	Pigeon	Sturgeon	Four Mile	Head/Rush	Shadow/Silver	# of Highs(3)	# of Mediums(2)	# of Lows(1)	# of Any	Weighted Value
Responsible development and construction	Urban and rural infrastructure	H	H	H	H	M	H	H	H	7	1	0	8	23
Shoreline naturalization	Stewardship	H	H	H	H	H	M	H	H	7	1	0	8	23
Urban stormwater BMP projects	Stewardship	H	H	H	H	H	M	H	H	7	1	0	8	23
Invasive species management	Stewardship	H	H		H	H	H	H	H	7	0	0	7	21
Coordinated monitoring of lake health	Research and monitoring	M	H	H	H	M	M	H	H	5	3	0	8	21
Septic system management	Stewardship	M		H	M	H	H	H	H	5	2	0	7	19
Keeping stakeholders informed	Communications and outreach	H			H	H	H	H	H	6	0	0	6	18
Implementing other community plans	Strategic planning	H	H		M	H	M	M	H	4	3	0	7	18
Management of public waterfronts	Urban and rural infrastructure	M	H		M	H	M	H	H	4	3	0	7	18
Public/technical advisory committees	Communications and outreach	H	H	H	H	H	M			5	1	0	6	17
Stormwater management planning	Urban and rural infrastructure	H	H	H	H	H				5	0	0	5	15
Aquatic plant management options	Communications and outreach	H	H		H	H	H			5	0	0	5	15
Agricultural BMP projects	Stewardship	M	H	H	M	H		L	L	3	2	2	7	15

Figure 1. **The prioritization matrix of recommendations and strategies to be carried out in accordance with the Lake Management Implementation Action Plan.**

$545,900 for shoreline, agricultural, rural and urban projects. The Township of Scugog was also a major contributor, providing $40,200 in grants, leveraging $146,200 in the same categories. These contributions made a significant impact on our ability to implement recommendations from our LMPs through shoreline naturalization, invasive species management, habitat restoration projects, agricultural stewardship projects, lake health monitoring and more.

Similarly, the **Kawartha Conservation Program** focuses on promoting and maintaining watershed health, while attracting community investment and building partnerships that leverage knowledge, effort, and impact to help achieve LMP objectives. One commonality between both programs is their grounding in stewardship, policy, and research, and it is this structure that drives Kawartha Conservation and partners to implement projects that make visible and long-lasting impacts on the health of our watershed.

The Ontario Ministry of Agriculture, Food, and Rural Affairs (OMAFRA) has been a significant contributor to this effort over the past three years, contributing $99,750 to support Kawartha Conservation's work with the farming community to create BMP demonstration sites to improve water quality. One such project was the completion of a constructed wetland with fencing and solar-powered watering system for cattle in partnership with Ducks Unlimited Canada and the landowner (fig. 2). Others included a tile drain control box project, two barnyard eavestrough rainwater harvesting systems, and four agricultural BMP promotional videos.

Figure 2. **An artificial wetland being constructed on the Summers' property in September 2021, as part of an agricultural project funded by OMAFRA**

The Erosion and Sediment Control (ESC) project has also been successful over the past three years in its objective of increasing local expertise and application of ESC standards and techniques when conducting site alteration projects. Information on ESC was presented through a symposium in Fenelon Falls that featured 10 guest speakers, 20 vendors, and drew over 100 attendees including members of the public, contractors, municipal partners, and government agencies (fig. 3). Information was also presented through multiple free, educational webinars as well as through the production of four instructional videos and five fact sheets detailing ESC practices and techniques.

Figure 3. **ESC Symposium held in Fenelon Falls (2019)**

In 2021, Kawartha Conservation leveraged this work and the work of our urban stewardship programs to attract an additional $75,000 investment from the Environmental Damages Fund. This funding will support the improvement of fish habitat across urban streams in the City of Kawartha Lakes by working with 10 private landowners interested in improving water quality and fish habitat.

Kawartha Conservation continued to conduct water quality, quantity, and nearshore monitoring, implement shoreline restoration projects, and research aquatic plant control with aid from increased funding and community involvement (fig.4). Consistent with the LMPs, efforts were expanded to include research on the use of aquatic thrusters ('bubblers') to control aquatic plant growth in nearshore locations, as well as collaborate with citizen scientists to close gaps in monitoring data such as keeping records on the spread of starry stonewort, an emerging invasive species in our watershed.

Lake Management Plan Implementation: A Three-Year Summary

Since 2019, Kawartha Conservation has collaborated with 146 citizen scientists and Ontario Tech University in nearshore monitoring efforts, with $53,500 in funding helping to leverage $92,000 in community investment over the last three years.

In quantifying impact, Kawartha Conservation has established partnerships with several academic institutions, more than 25 community and municipal partners, and hundreds of community members throughout the Kawartha Lakes watershed over the past three years.

Figure 4. **Kawartha Conservation staff conducting water quality testing as part of the newly developed Lake Dalrymple Management Plan, in partnership with the City of Kawartha Lakes (2021)**

Summarizing the past three years tells the story of a community that is passionate about sharing knowledge and protecting the land, water, and future of the Kawartha Conservation watershed. It tells a story of the triumphs our community has made in the name of environmental stewardship through research, policy, collaboration, and action. But it also becomes clear that policy and action is a product of collaboration and informed decision making, which requires many hands and more open and accessible data to make the greatest impact. Kawartha Conservation remains committed to this collaboration model, focusing community stewardship activities on high priority sites, seeking, and attracting external investment, and closing knowledge gaps and providing more open and accessible data.

And the story doesn't end here.

Kawartha Conservation will be working with community stakeholders to draft a new Lake Management Implementation Action Plan for 2024. This group will be working through the next year and a half to develop the plan so that all partners can see where they fit in helping to protect and improve our lakes for future generations.

To read Kawartha Conservation's Lake Management Plans, visit:
https://www.kawarthaconservation.com/LakePlans/

KLSA Photography Contest Runners-up

Feathered friends on Lake Scugog. **Photos by: Rachelle Mack**

Community Science to the Rescue

How nearshore nutrient data was captured across the Kawartha Lakes during the first year of the COVID-19 pandemic

Erin Smith
Ph.D. candidate, Ontario Tech University, Oshawa

When the COVID-19 pandemic hit Ontario in spring 2020, it resulted in many direct and indirect impacts to our daily lives that are still reverberating. One such impact is the effect that altered human activities has had on the environment. With a provincial lockdown in place during the first wave of the pandemic, most people spent more time at home and/or at the cottage, which altered their normal habits and routines. With national and international travel restricted, residents in 'stay-cation' mode may have had more time to tend to their lawns and gardens. Some property owners living in the United States may have opened their cottages up to the popular rental market during the summer of 2020. With these major shifts in human presence and activity in the Kawartha Lakes watersheds, it begged the question of whether or not lake water quality was also impacted? Being able to address this question was a major challenge in 2020, when most lake monitoring programs, such as the Lake Partner Program, were paused, and research labs, such as at Ontario Tech University, were closed.

As a doctoral candidate who studies the nearshore zone in the Kawartha Lakes, the lockdown measures had a major impact on my research plans. However, through partnerships with organizations such as the Kawartha Lake Stewards Association and Scugog Lake Stewards, we were able to work together to pivot my water quality study to one that was pandemic compliant. By tapping into lake association and First Nation networks, I was able to implement a community science (formerly known as 'citizen science') lake monitoring program that was safely conducted through social distancing. We had an overwhelmingly positive response from area residents, 60 of whom representing 16 lakes were trained as community scientists to collect water samples adjacent to shorelines across the Kawartha Lakes region (Figure 1). Between June – September 2020,

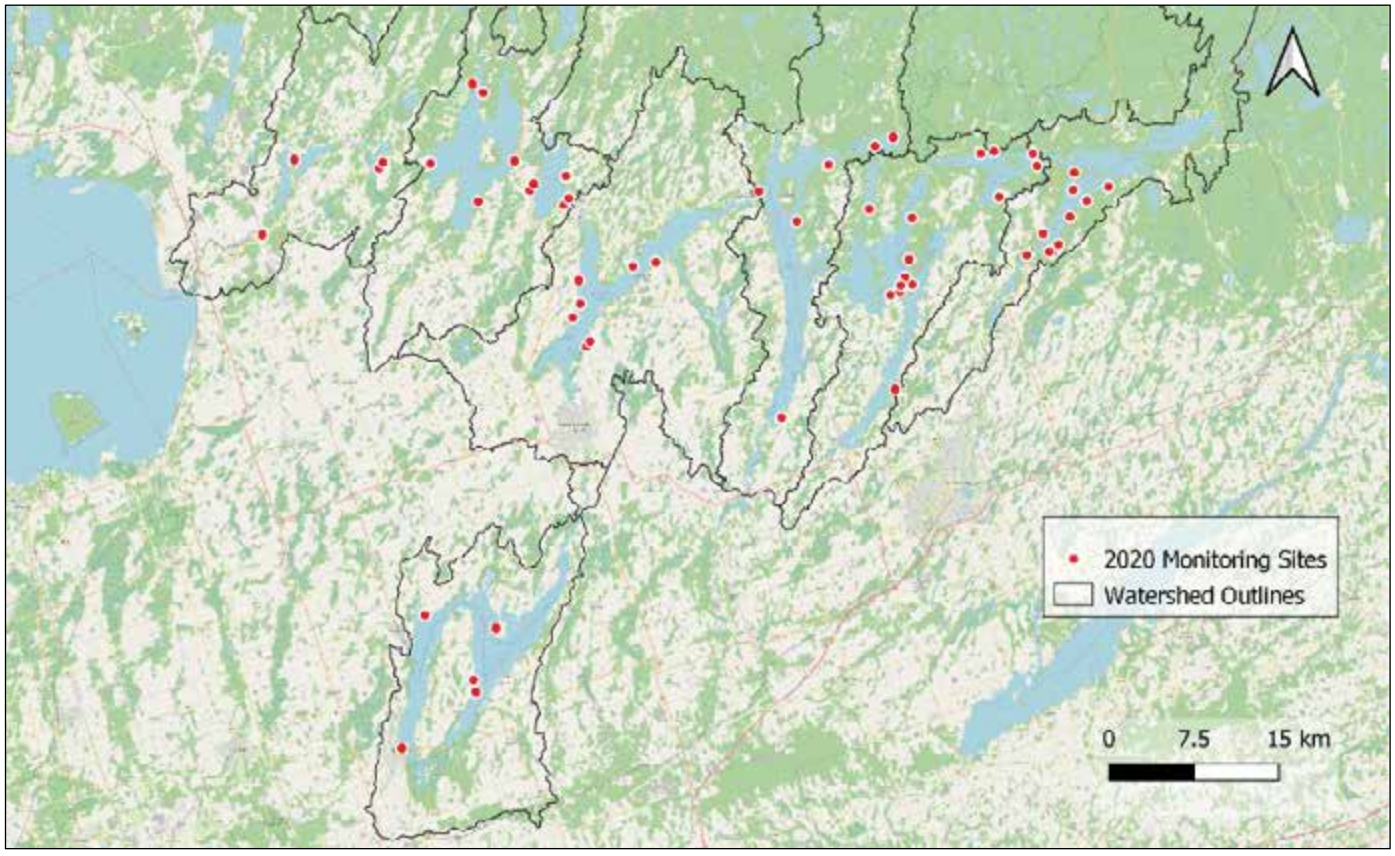


Figure 1. **Water monitoring sites for the 2020 season with watersheds outlined.**

volunteer community scientists collected monthly samples and recorded environmental observations. Critical to the success of this initiative was that community scientists agreed to store water samples in their freezer until the end of the field season. By the fall of 2020, my lab at Ontario Tech was open again for research, allowing me to collect all of the frozen water samples at drop-off depots to bring them back to the lab for processing and analysis.

The community science design of this study permitted us to study many lakes concurrently over the summer field season. The broad geographic range, from Canal Lake in the west to Ston(e)y lake in the east, allowed me to examine spatial patterns and monthly trends. The samples collected also filled an important data gap in the Kawartha Lakes, since no other comparable region-wide lake monitoring was happening in 2020. Phosphorus levels measured across the lakes were generally highest in the centrally located lakes connected to the Trent-Severn Waterway (TSW), from Scugog to Upper Buckhorn Lake (Figure 2). Although centrally located in the study region, Sandy Lake is not directly connected to the TSW lakes. Interestingly, it had the lowest phosphorus levels of any of the study lakes, even though it is quite close to Pigeon and the Buckhorn lakes. Overall, most of the Kawartha Lakes in the study could be classified as mesotrophic based on their phosphorus levels. Mesotrophic means "medium productivity", which (depending on the water quality goals of a given lake) can be desirable if lake-health targets aim for abundant aquatic vegetation and fish communities.

Another fortunate aspect of being able to collect water samples during the pandemic, was that it allowed me to compare nearshore water quality data from before the pandemic (2019) with data collected during the pandemic (2020 and 2021) in Balsam, Cameron, Sturgeon, and Pigeon Lakes. In this subset of lakes, we found no difference between phosphorus levels in 2019 and 2020, but 2021 levels were significantly lower than the two previous years (Figure 3). Several factors could have caused this difference, but one important consideration is climate. When comparing the amounts of precipitation across years, I found that 2019 and 2020 had very similar summer precipitation levels, but 2021 was significantly wetter, with more precipitation

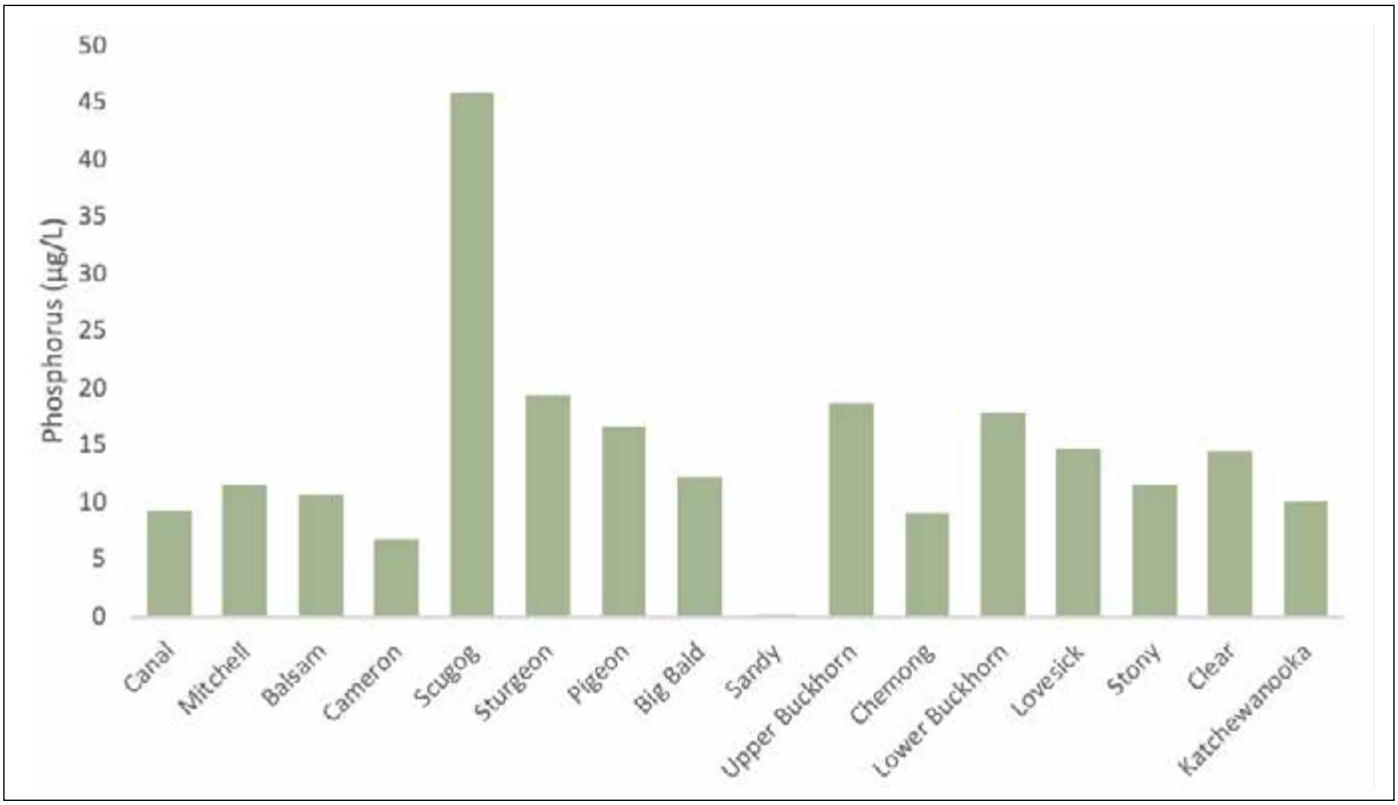


Figure 2. **Bar plot of average phosphorus in the Kawartha Lakes studied in 2020.**

preceding sampling dates, and more precipitation and storm events overall. The impact of precipitation on a water body is largely controlled by the surrounding watershed, including soil permeability, land cover, and land-use activities. Generally, increased precipitation leads to more surface runoff and increased nutrients entering a waterbody. However, we saw the opposite occurring, where nutrient levels were lower during a wetter year. This finding is intriguing, because it suggests that other factors are more important than climate in controlling lake nutrient levels.

Finally, to assess if there was a connection between nutrient concentrations and shoreline-resident activities and behaviours during the summer of 2020, I conducted an anonymous survey that was sent to participating community scientists. Even though there were anecdotal reports of more people moving to the cottage and spending extended periods there during the pandemic, the survey results showed that there was no significant change in the number of days spent at waterfront residences, nor the number of people spending time at their property. Respondents indicated a slight change in their habits with increased handwashing, detergent use, and water use. These habits are of interest as almost all respondents' properties had septic systems, which can be less effective when overused and subjected to higher concentrations of sanitization chemicals. It is important to note that most respondents were permanent residents.

As I continue to analyze the data collected from the 2020 pandemic field season, I expect to elucidate the role of watershed land-use in contributing to in-lake nutrient concentrations, from the local to regional scale. Clearly, lake connectivity to the TSW plays a role in regulating nutrient levels, particularly for those lakes downstream of Lake Scugog, the most nutrient rich lake in the study region. Now that the Lake Partner Program is operating again, lakes across the Kawartha Lakes region can continue to be monitored for their clarity and nutrient status. Be sure to contact your local lake association or stewardship group to learn how you can participate in the Lake Partner Program to ensure that your lake is being monitored.

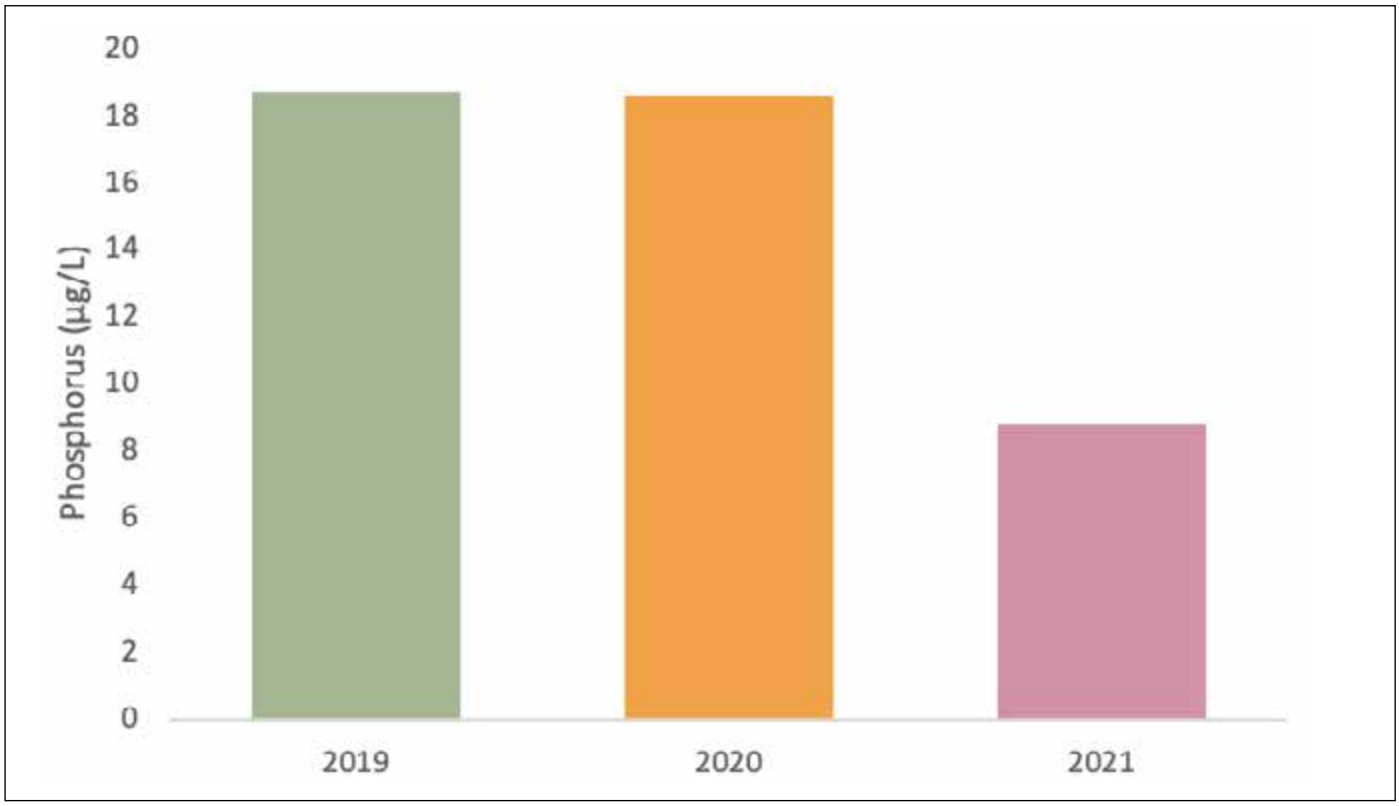


Figure 3. **Bar plot of average annual phosphorus in the Kawartha Lakes where we had previously monitored: Balsam, Cameron, Sturgeon, and Pigeon Lakes.**

Tracking Water Temperatures and Dissolved Oxygen in the Kawartha Lakes

Brett Tregunno,
KLSA Director

The Kawartha Lake Stewards Association (KLSA) has been working to increase the profile of climate change and its potential impacts on our lakes. In 2020, with the help of community volunteer samplers, we initiated a pilot program to track water temperatures and dissolved oxygen concentrations in our nearshore and offshore waters. A warming climate is expected to result in warmer water temperatures and lower dissolved oxygen, which could have consequences for life in and around our lakes. Volunteers collect data in the shallow waters along their shoreline (water temperature) and in the deeper basin in the middle of the lake (dissolved oxygen and water temperature).

Annual nearshore water temperatures

Although we've only been collecting data for two years, the limited data we do have (13 records) is beginning to paint a clearer picture of annual nearshore water temperature patterns across our lakes (Figure 1). Water temperatures change throughout the year in a similar fashion to air temperatures. Beginning in March our lakes warm rapidly and are at their hottest in summer (June, July, and August). Summer is a period of relative stability when temperatures fluctuate between 19 and 31ºC, but average values remain around 25ºC. Beginning in September, our lakes cool rapidly until they reach the cold stable period from mid-December until March.

2021 Summer nearshore water temperatures

In the summer of 2021, patterns in average daily nearshore water temperatures at six nearshore sites were heavily influenced by ambient air temperatures (Figure 2). Water temperatures became warmer as the summer progressed until their peak around the third week of August (in 2020, water temperatures peaked around the second week of July). Daily temperatures were markedly similar between sites (varying by less than 3ºC), with the Buckhorn-Upper site being the warmest and most variable (e.g., higher highs, and lower lows) and the Katchewanooka site being the coldest and most stable.

Drivers of temperature fluctuations

Certain nearshore sites seem to be more (or less) sensitive to air temperature changes (Figure 3). One explanation for this might be whether or not the site is located along a shoreline that is usually sheltered, shallow, and/or not along the main Trent-Severn Waterway (TSW) flow path[1]. For example, extreme daily fluctuations of about 5 to 10ºC were recorded at the Sandy Creek site (a shallow and surface water fed creek known to respond rapidly to changes in air temperatures), moderate fluctuations were recorded at the Buckhorn-Upper site (located in a protected bay), and the lowest fluctuations of about 1 to 2ºC were recorded at the Katchewanooka site (a well mixed, flow-through lake).

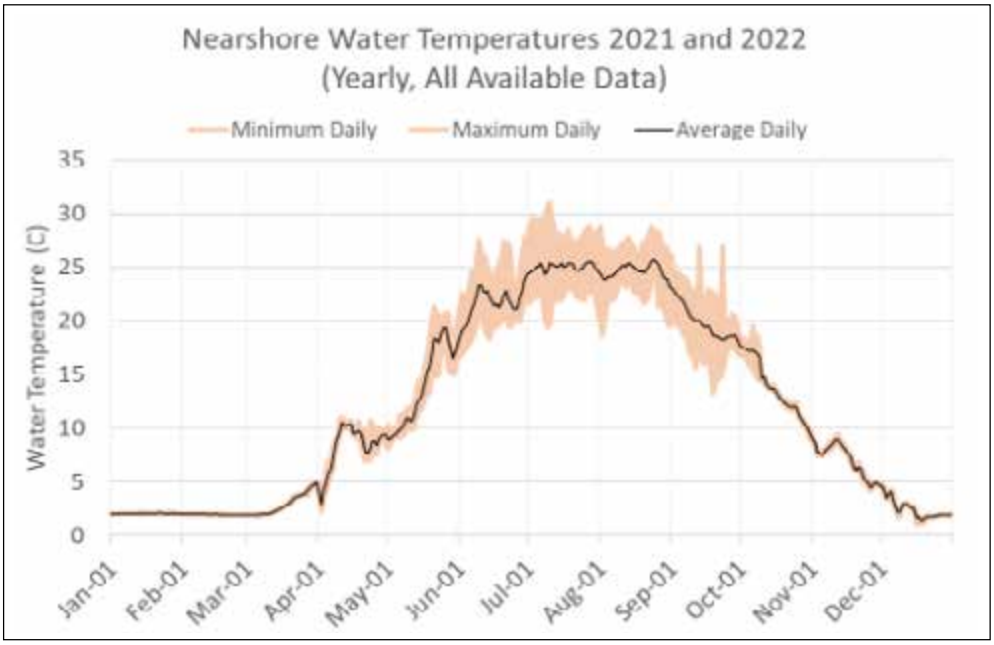


Figure 1: **Yearly patterns in nearshore water temperatures. Currently, much more data is available for June, July, August, and September than for the remainder of the year.**

[1]Increased volumes of flow along the TSW system have been demonstrated to influence (lower) phosphorus concentrations – (see article in this report Lake Partner Program 2020 Testing Results) and to influence (reduce) the timing of thermal stratification – (see article The Effect of Flow on Temperature, Dissolved Oxygen and Conductivity Profiles in Lake Katchewanooka in this report).

Tracking Water Temperatures and Dissolved Oxygen in the Kawartha Lakes

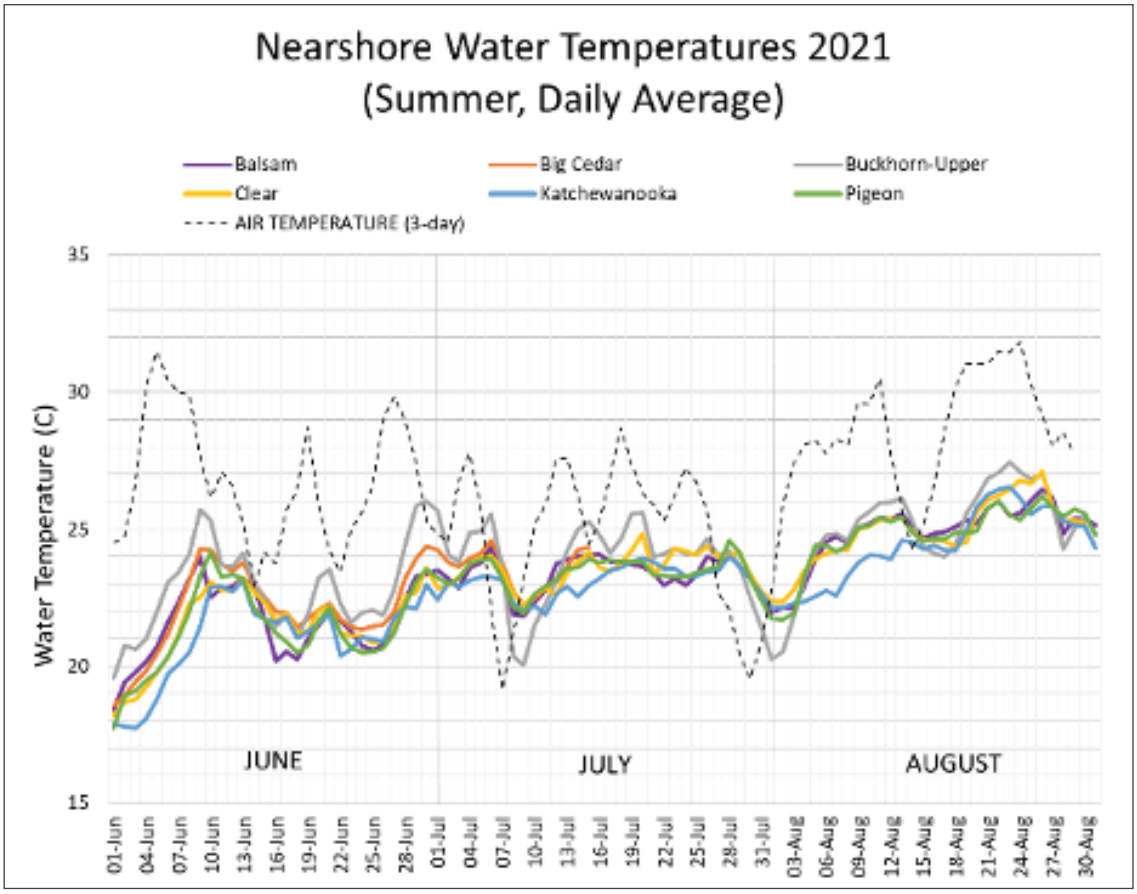


Figure 2: **2021 daily average nearshore water temperatures and air temperatures in the summer (recorded at Trent University, Peterborough).**

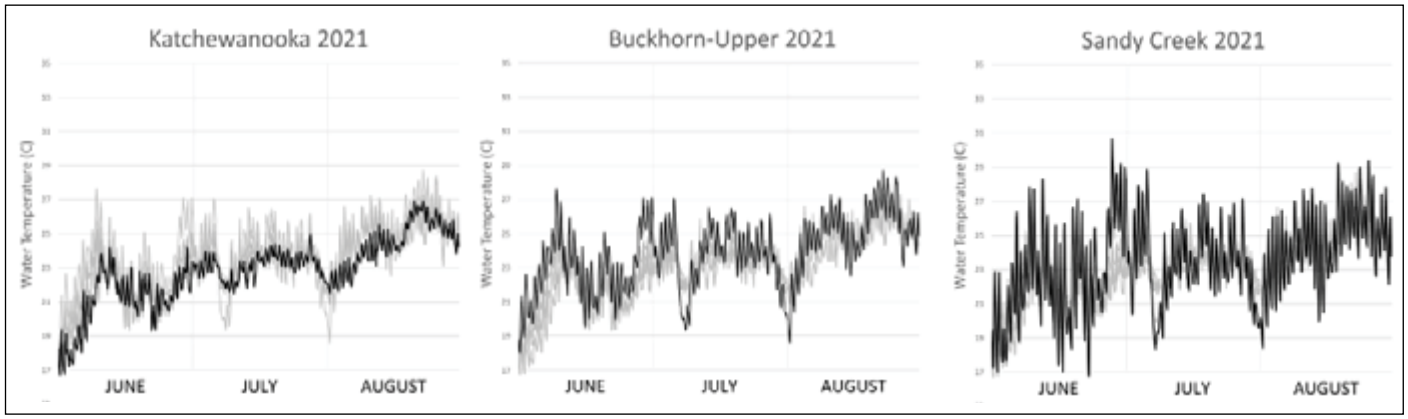


Figure 3: **2021 hourly water temperatures in the summer at three representative sites (black lines): flow-through (Katchewanooka), protected-bay (Buckhorn-Upper), and surface-fed creek (Sandy Creek), in relation to all sites (grey lines).**

Tracking Water Temperatures and Dissolved Oxygen in the Kawartha Lakes

2021 Late summer deep basin water temperatures and dissolved oxygen

Deep basin sampling at 10 sites in late summer (between mid-August and mid-September) revealed that most lakes developed a layered (stratified) water column, with warmer waters resting above colder waters separated by a rapid temperature decline called the 'thermocline' between a depth of 6 to 10 m (Figure 4). The depth of thermocline also coincided with a significant decline in dissolved oxygen concentrations with values in most lakes dropping to values near the bottom that are considered too low (less than 1.0 mg/L) for fish populations. The only lakes that had uniform temperatures and dissolved oxygen throughout their water column (Sturgeon and Pigeon) were likely stratified just prior to sampling, but increased flows coinciding with a period of relatively cool air temperatures in early-to-mid September likely caused the thermocline to disappear.

Data summary tables

With our limited available data it's too early to quantify how much water temperatures and dissolved oxygen concentrations are changing as result of climate change. However, by tracking several key indicators on a yearly basis (Table 1) we are starting to piece together a more comprehensive understanding of these important variables and potential consequences on lake health. Future efforts will focus on establishing a core set of 'fixed-sites' at nearshore and offshore locations for water temperature monitoring, ensuring that deep basin sampling is undertaken when the lakes are stratified, and determining which lakes are most vulnerable to a changing climate.

KLSA would like to send a special thanks to the 15+ volunteers who have dedicated their time in support of this program. If you are interested in monitoring water temperature or dissolved oxygen on your lake, please contact KLSA for more information.

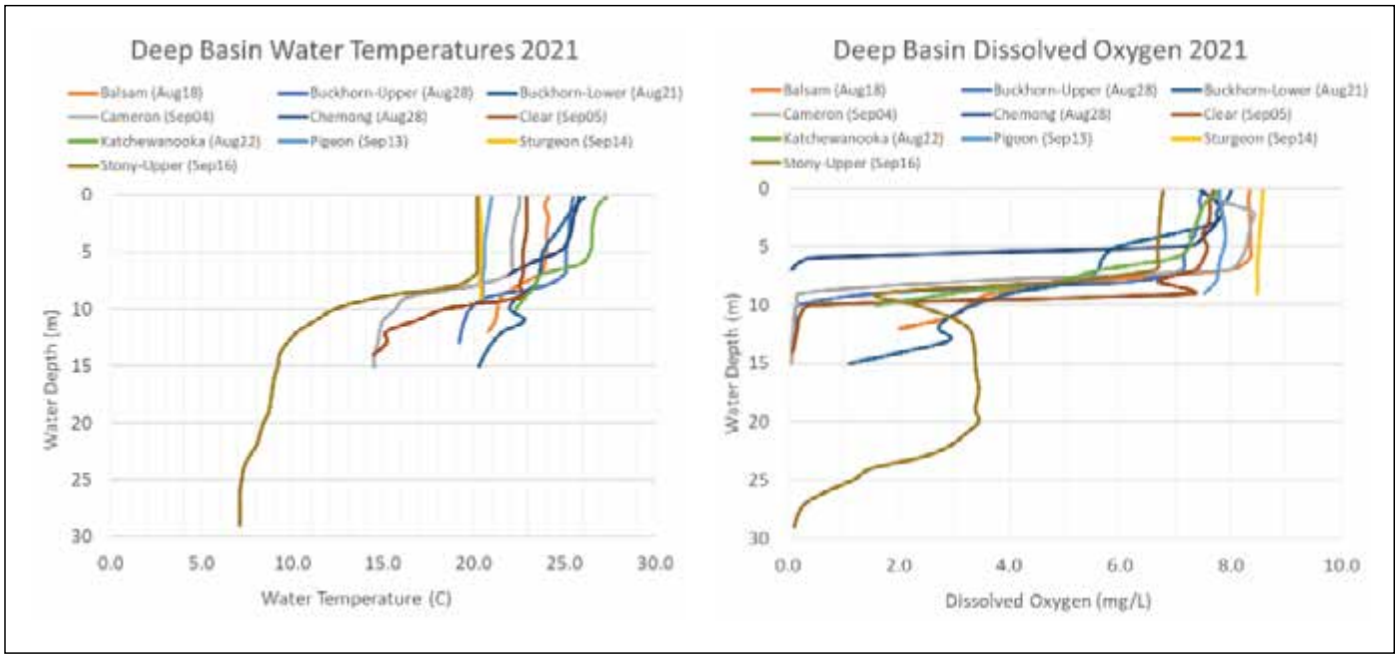


Figure 4: **2021 water temperature and dissolved oxygen concentrations at deep basin sites in late summer at 1 m increments from surface to bottom.**

Tracking Water Temperatures and Dissolved Oxygen in the Kawartha Lakes

Table 1: **A summary of data used for annual tracking of water temperature and dissolved oxygen.**

	Nearshore Sampling (June, July, August)			Deep Basin Sampling (August 15th to September 15th)		
	Number of days above 25 °C (#)	Average of daily maximums (°C)	Average of all temperatures (°C)	Depth of thermocline (m)	Surface water dissolved oxygen (mg/L)	Bottom water dissolved oxygen (mg/L)
Big Cedar	10[1]	23.6[1]	22.9[1]	n/d[2]	n/d[2]	n/d[2]
Balsam	35	24.4	23.3	8	8.3	2.5
Buckhorn-Lower	n/d[2]	n/d[2]	n/d[2]	9	7.9	1.6
Buckhorn-Upper	58	25.1	23.9	8	7.5	0.1
Cameron	n/d[2]	n/d[2]	n/d[2]	8	8.0	0.1
Chemong	n/d[2]	n/d[2]	n/d[2]	6	7.7	0.3
Clear	33	24.2	23.3	10	7.6	0.1
Katchewanooka	17	23.6	22.8	7	7.6	2.3
Pigeon	33	24.0	23.2	None[3]	7.8	7.6[3]
Sandy Creek	62	25.8	23.5	n/a[4]	n/a[4]	n/a[4]
Stony-Upper	n/d[2]	n/d[2]	n/d[2]	8	6.8	0.1
Sturgeon	n/d[2]	n/d[2]	n/d[2]	None[3]	8.6	8.5[3]
AVERAGE[5]	**35.2**	**24.3**	**23.3**	**8.0**	**7.8**	**0.9**

1. *Data only available from June 1st to July 15th.*
2. *No data available.*
3. *No thermocline present, water column was mixed by time of sampling (Sep 13, Sep 14).*
4. *Not applicable – site is on a creek.*
5. *Average of all values not shaded in grey.*

Buckhorn Lake at dawn **Photo by: Douglas Burrell**

Julian Lake **Photo by: David MacLellan**

The Effect of Flow on Temperature, Dissolved Oxygen & Conductivity Profiles in Lake Katchewanooka

Mike Dolbey, Ph.D., P. Eng.,
KLSA Director

In 2020, KLSA acquired an instrument to measure temperature, dissolved oxygen (DO) and conductivity and used it to collect depth profiles of these parameters in a number of Kawartha area lakes - Pigeon, Buckhorn, Lovesick, Katchewanooka and Big Cedar. The results were reported in last year's annual report by Brett Tregunno (KLSA 2020 ALWQR, page12, KLSA 2021). The results showed that a thermocline developed during the summer in all the lakes tested and that below the thermocline DO levels declined to low levels. However, after the beginning of September the thermocline collapsed (mixing resulted in uniform temperature from top to bottom) in the first four lakes, all of which are on the main flow path of the Trent-Severn Waterway (TSW), but not in Big Cedar Lake, a feeder lake to the north with a relatively small watershed and an outflow into Eels Creek which empties into Upper Stoney Lake.

During its operating season, May 24th to Thanksgiving, the TSW must maintain water levels for boat traffic and a minimum flow to service water and wastewater treatment plants along the system. They do this by storing large reserves of water in the many feeder lakes throughout northern Peterborough and Haliburton Counties during the spring flood and releasing water as required throughout the season. Towards the end of the TSW operating season, water remaining in the feeder lakes must be drained down before freeze-up to allow the system to absorb the next year's snow melt. I had previously speculated that increased TSW flow after the beginning of September may be responsible for the reduction in Total Phosphorus (TP) levels that we observe in Kawartha Lakes on the TSW flow path. After seeing the collapse of the thermocline in our 2020 measurements in early September, I again speculated that an increase in TSW flow may be causing this effect due to mixing. To test this hypothesis, I carried out a series of DO, temperature and conductivity profile measurements in Lake Katchewanooka during 2021.

Figure 1. **Kawartha Lakes watershed that drains through Lake Katchewanooka.**

Lake Katchewanooka is the lowest of the Kawartha Lakes situated between its inlet at Young's Point and outlet at Lakefield, Ontario. It is part of the Trent-Severn Waterway (TSW) and the water flowing into it at Young's Point is the drainage of the entire Kawartha Lakes watershed covering 7,235 km^2, Figure 1. Being part of the TSW, the water levels in Lake Katchewanooka are controlled to provide fairly constant levels during the Waterway operating season. Because of the large size of the watershed, a lot of water is generated by spring snowmelt or widespread heavy rain events that has to pass through Lake Katchewanooka. This results in high flow volumes at these times.

As shown in Figure 2, Lake Katchewanooka is a narrow, seven-kilometer-long lake. Before a dam was built in Lakefield, it was a series of three small lakes separated by rapids between islands. Built in about 1846, the first successful Lakefield dam raised the water level at the dam by 1.1m (43 inches) flooding the rapids and much of the shoreline to create the lake as it is today. However, the islands remain to create narrows that provide considerable resistance to high water flows. During times of high flow, water backs up behind the islands resulting in a higher water level at the inlet of the lake than at the outlet at the dam in Lakefield. The difference in these two water levels increases as the flow volume increases. The water level at the Lakefield dam is provided by the TSW on their website. I measure the water level at my dock near the top end of the lake at the location shown in Figure 2. I also live close to the Young's Point dam and can measure the amount of gate opening which determines the amount of inflow to the lake. In addition to the dam opening there is some flow due to lockage and leakage, but these are relatively small.

The Effect of Flow on Temperature, Dissolved Oxygen & Conductivity Profiles in Lake Katchewanooka

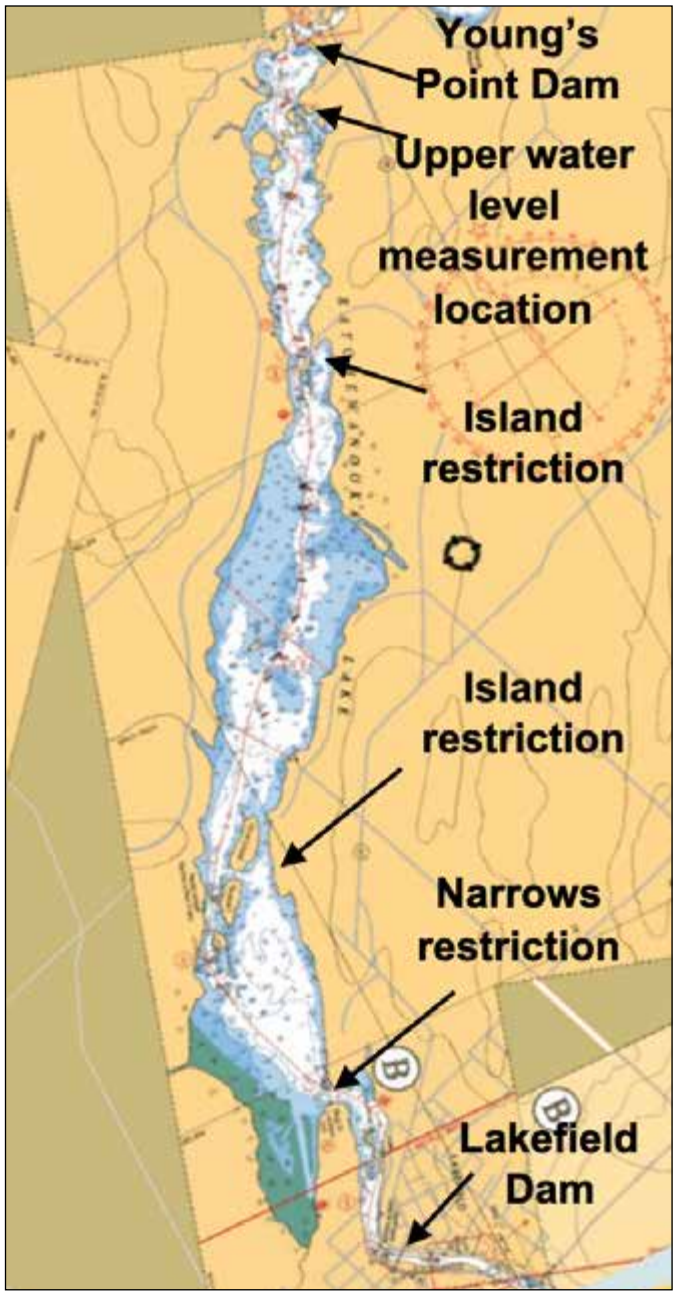


Figure 2. **Lake Katchewanooka showing flow restrictions and water level measurement locations**

Figure 3 shows the difference in water level, the flow differential head, between Young's Point and Lakefield measured between April 1 and October 31, 2021, and also the amount of dam opening at Young's Point during most of this period. The two curves are similar and are a good indication of the volume flow through the lake during this time. Also shown is the cumulative rainfall between April and October, 2021, measured at my property near

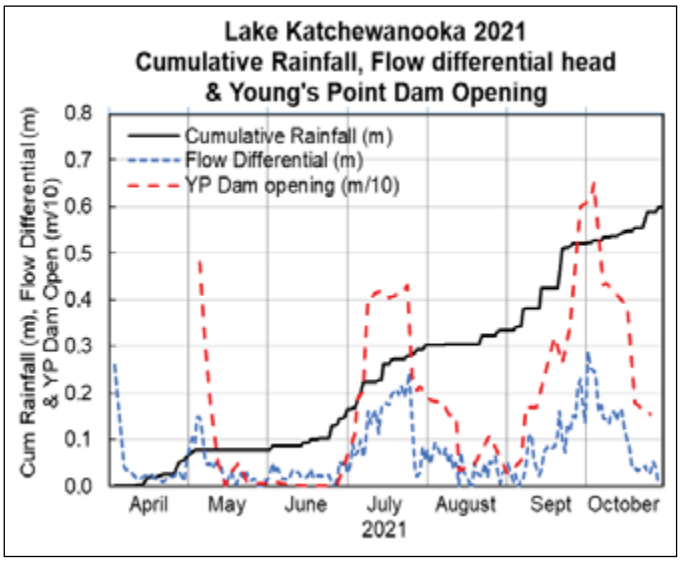


Figure 3. **Cumulative rainfall, flow differential head and Young's Point dam opening in Lake Katchewanooka from April 1 to October 31, 2021.**

Young's Point. As shown by the cumulative rainfall curve, the summer of 2021 consisted of long periods of drought followed by periods of widespread heavy rain. This resulted in alternating periods of very low flow followed by periods of very high flow as the TSW struggled to maintain stable navigation conditions on the waterway.

Approximately 60 m from my dock on Lake Katchewanooka is a location where the water is about 7.5 m deep where I have done TP sampling for many years. During 2021, I performed temperature, DO and conductivity vs. depth profile measurements at this location every 5 to 10 days between April 17 and October 24 with the results shown in Figure 4. The many vertical profiles in these plots show relatively constant temperature, DO and conductivity at all depths. These measurements occurred during periods of high flow and indicate that the lake water was well mixed from top to bottom. During periods of low flow, a thermocline developed at about 3 m depth with warm, oxygen-saturated water above and cooler, oxygen-depleted water below. During these periods, the level of dissolved oxygen at the bottom decreased over time as respiration processes below the thermocline consumed it. Also, during these periods of low flow, the conductivity of the water increased progressively indicating a buildup of metal ions such as calcium and sodium resulting from oxidation processes and a lack of flushing. These results are summarized and shown in relation to

The Effect of Flow on Temperature, Dissolved Oxygen & Conductivity Profiles in Lake Katchewanooka

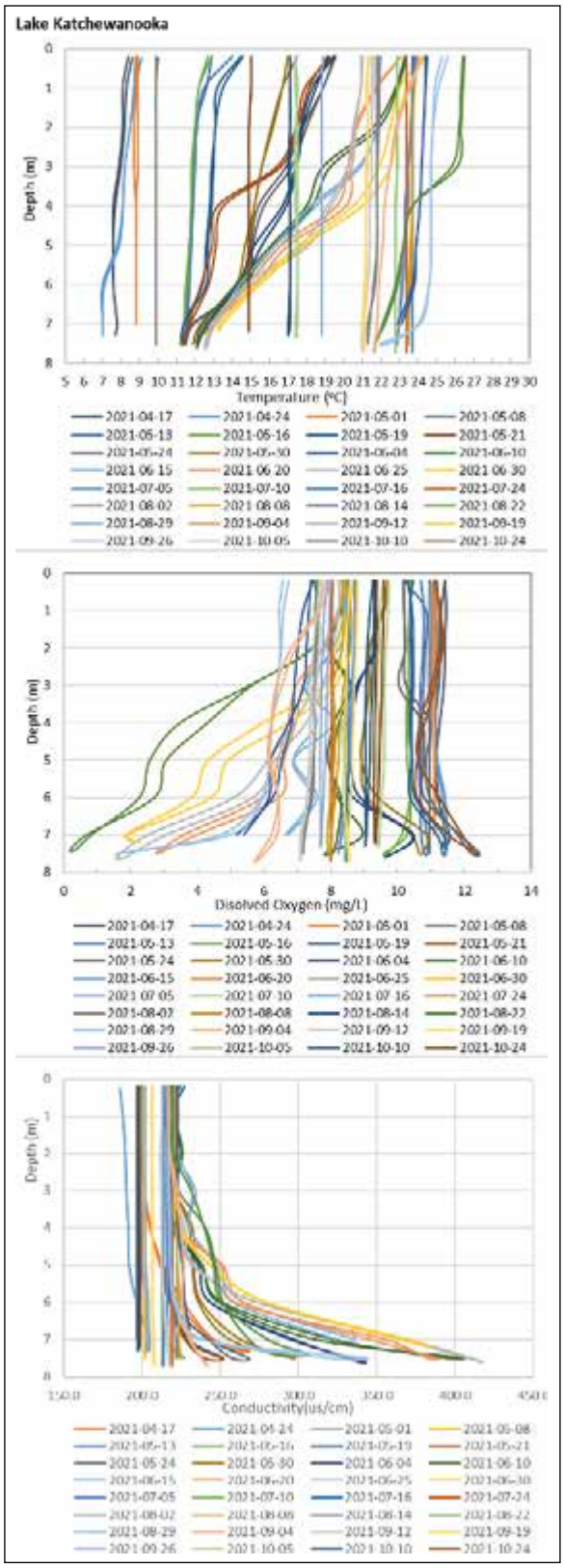


Figure 4. **Temperature, Dissolved Oxygen and Conductivity vs. depth profiles in Lake Katchewanooka between April 17 & October 24, 2021**

flow in Figure 5. The values of temperature, DO and conductivity at the surface and at the bottom are plotted over time and can be seen in relation to flow shown in the top graph.

The spring flood was very early in 2021 and TSW flow was unusually low when measurements began in mid-April. Although surface water temperature was 10ºC, a slightly lower temperature was measured at the bottom but DO remained high. Widespread rain at the end of April resulted in a period of moderate flow that resulted in mixing of the water from top to bottom. This was followed by a period of about six weeks with little rain and very low flow. A thermocline began to form immediately with bottom temperatures remaining between 10 and 12ºC while surface temperatures climbed to the mid-twenties. During the early part of this period, DO at the bottom actually exceeded that at the surface. This may be because cold water holds more DO than warm water and early in the year biological respiration processes were not yet consuming much oxygen below the thermocline. As the season progressed and plant and algae growth resumed in late May, DO in the bottom waters was consumed causing a rapid drop. Heavy rains at the end of June and early July led to about four weeks of moderately high flow while the TSW fought to maintain water levels without flows that might endanger navigation. This caused total mixing of the water column with uniform temperature, DO and conductivity from top to bottom. By early August TSW flow was low again for about a month and a thermocline redeveloped but bottom temperatures were only about 5ºC below surface temperatures. During this period DO at the bottom declined to close to 0 mg/L before gradually rising as flow increased in early September. Heavy rain in September resulted in a resumption of high TSW flow and fully mixed conditions to the end of the measurement period.

These results clearly show that at my measurement location in Lake Katchewanooka, flow is a significant factor in whether or not a thermocline develops with its associated decline in dissolved oxygen in the bottom water of the lake. It is unclear to what extent this result can be applied to other Kawartha Lakes, most of which are wider and deeper than Lake Katchewanooka. For the same volume of water flow, the velocity of flow increases as the cross-sectional area is reduced. Mixing of top and bottom water is more likely to occur where flow velocity is higher.

The Effect of Flow on Temperature, Dissolved Oxygen & Conductivity Profiles in Lake Katchewanooka

To evaluate the importance of flow velocity, comparative measurements could be made in a broader, deeper lake such as in Clear Lake just north of Young's Point where the volume flow would be essentially the same as in Lake Katchewanooka. However, with a maximum depth of 12 m and width of 1500 m, the cross-sectional area of this part of Clear Lake is approximately 18 times greater than at my Lake Katchewanooka measurement location so the flow velocity should be approximately 18 times lower. Another interesting season of measurements awaits.

Acknowledgement: I thank Dr. Robert Bailey of Ontario Tech University for the loan of the YSI ProQuatro hand-held meter used in this study, and for his encouragement and helpful comments.

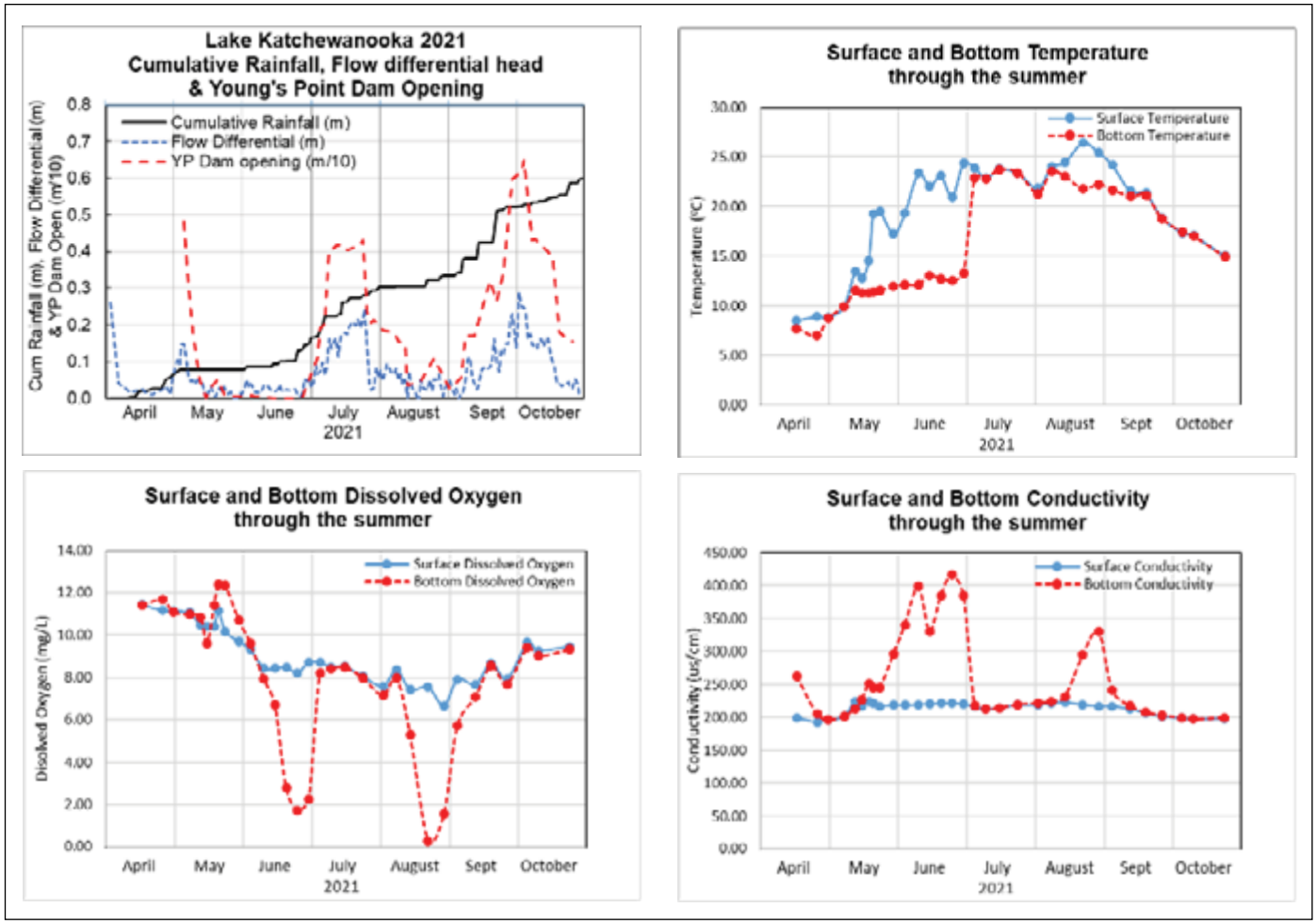


Figure 5. **Change in surface and bottom values of temperature, dissolved oxygen, and conductivity with flow in Lake Katchewanooka between April 17 & October 24, 2021**

Life on Pigeon Lake
Photos by: Dan Barna

Fighting Aquatic Invasive Species in the Kawarthas and Beyond

Matthew Robbins, *Aquatic Invasive Species Outreach Liaison, Invading Species Awareness Program, Ontario Federation of Anglers and Hunters*

Aquatic Invasive Species (AIS) are one of the greatest threats to Ontario's freshwater ecosystems today. Many of our cherished lakes and rivers have already suffered due to the presence of species like Eurasian water-milfoil, Round Goby, or starry stonewort. In the Kawartha Lakes, especially, aquatic invaders have become an unfortunate and destructive reality for boaters, cottagers, and other year-round water-users.

Although management is important, the role of prevention should not be underestimated in the fight against invasive species. Once established, many AIS can be extremely difficult to eradicate, making prevention of their initial introduction vitally important. This may seem obvious of species that do not yet exist in the province or country, but it is equally true of AIS that **are** present in Ontario, but which only inhabit certain waterways. Preventing further spread of AIS reduces their overall impact and gives experts more opportunity to develop effective management solutions.

Pathways of spread

AIS have the potential to enter and spread throughout Ontario through several different pathways, from attaching to scuba gear or float plane equipment, to traveling through lock systems and canals. Some species, like black crappie, have even been released deliberately in a misguided attempt to establish new recreational opportunities.

In the Kawarthas, however, the most influential AIS pathway of spread is likely boating. Watercraft of all kinds offer an easy ride for aquatic hitchhikers when they travel between waterbodies, and many problematic AIS species have been distributed across our region in exactly this way.

The Clean, Drain, Dry message

To prevent the accidental spread of AIS, it is important that boaters clean, drain, and dry (CDD) their vessel every time they leave or enter a waterbody.

The CDD process goes like this:

Clean the boat and all related equipment before leaving a waterbody, and ensure it is clean before entering a new one. Look for any mud, vegetation, mussels, or other debris stuck in or on the vessel and its equipment;

Drain all standing water before leaving a waterbody by pulling the transom plug, emptying your livewell, lowering the motor, and draining all other water-containing devices on the vessel;

Dry the watercraft for at least five days in sunlight before placing it into a new waterbody in order to eliminate any unseen AIS. Alternatively, you can clean the boat from top to bottom using hot water over 50°C or with pressurized water between 2,500 and 3,000 psi (most modern pressure washers, like those available at the carwash, meet this threshold).

Taking action

It is with this CDD message in mind that, in 2019, Great Lakes States, Provincial agencies, and partner organizations came together to create the Great Lakes AIS Landing Blitz, a multiyear project with the goal of educating Great Lakes boaters and anglers on AIS prevention. Since its inception, this program has operated for one week each summer, during which time volunteers have engaged with tens of thousands of boaters and anglers across the Great Lakes, and even more online.

Using the momentum created by the Great Lakes AIS Landing blitz, and with funding from the Ontario Trillium Foundation's Grow Grant program, the OFAH is now bringing the same important message inland with our new **Water Steward Program**.

The Water Steward Program, first launched in 2021, focuses on educating boaters within the Durham, Haliburton, Kawartha, and Pine Ridge regions of Ontario. Volunteers in our program are given the knowledge and resources necessary to engage with boaters/anglers on a number of AIS related topics, from CDD and AIS prevention, to regulation, species

Think you've seen an invasive species?

Report it! using the EDDMapS app or website, or by contacting the Invading Species Hotline at 1-800-563-7711 or by email info@invadingspecies.com

identification, and more. During the open-water season, volunteers and Invading Species Awareness Program (ISAP) staff work together to organize 'boater engagement events' at local boat launches, where volunteers interact with boaters as they come and go from the launch. Willing watercraft users are given a walk-through of how to perform an 'AIS check' of their vessel and are provided with helpful resources.

ISAP staff at a public awareness event on Chandos Lake
Photo credit Matt Robbins

This summer, our Water Stewards will be setting up at boat launch locations across the Kawarthas and surrounding area, hoping to reach as many anglers and recreational boaters as they can. If you see our tent, come on up for a free chamois and CDD resource! Some locations will even be offering free boat-washing.

Regulatory changes

The Ontario Provincial government is also taking serious action to control the spread of aquatic invasive species. As of January 1, 2022, recently announced changes to the Invading Species Act, 2015, will come into effect which officially regulate the boater pathway.

The new rules are as follows:

"A person shall not transport watercraft overland, unless

i. drain plugs and other devices used to control drainage of water from the watercraft and watercraft equipment have been opened or removed

ii. reasonable measures have been taken to remove any aquatic plants, animals or, algae from the watercraft, watercraft equipment, and any vehicle or trailer used to transport the watercraft or watercraft equipment overland

Prior to reaching a launch site for a body of water, the watercraft, watercraft equipment and any vehicle or trailer used to transport the watercraft or watercraft equipment must not have an aquatic plant, animal or algae attached to it

No person shall place a watercraft, watercraft equipment, or any vehicle or trailer used to transport a watercraft into any body of water if the watercraft, watercraft equipment, vehicle or trailer has an aquatic plant, animal or, algae attached" O. Reg. 354/16

For a complete summary of the new regulatory changes made to the Invading Species Act, 2015, visit: https://ero.ontario.ca/notice/019-3465

A step further

These changes represent a positive step towards maintaining the health of Ontario's lakes and rivers, but they do not include every stage of the CDD process. Since many organisms, like microscopic zebra mussel veligers or Chinese mystery snails, can remain undetected and alive out of water for extremely long periods of time, we encourage everyone to go above and beyond these new regulations by completing the final step of **DRY** (or disinfect) every time they leave a waterbody. As outdoor recreationists, it is important that we do everything in our power to prevent the accidental spread of these problematic AIS, not only into our home waters here in the Kawartha Lakes, but from our waterways into neighbouring systems as well.

If you would like to become involved in the Water Steward Program, or to learn more about this or any other ISAP project, you can visit our website at: http://www.invadingspecies.com/

Or contact me, Matt Robbins, at: matthew_robbins@ofah.org

Ontario Trillium Foundation
Fondation Trillium de l'Ontario

ONTARIO'S INVADING SPECIES AWARENESS PROGRAM

ONTARIO FEDERATION OF ANGLERS AND HUNTERS

Making a Difference: The Evolution of Starry Stonewort Monitoring

Carol Cole,
KLSA Director

In late summer of 2018 my observant neighbour, Patty MacDonald, identified starry stonewort (SSW) in the small bay between our properties on Stony Lake. Throughout the winter of 2019 we talked to everyone we could think of to find out information about SSW. The Invading Species Awareness Program (ISAP) told us starry stonewort was not being tracked in Ontario. The Invasive Species Centre and the Ontario Invasive Plant Council (OIPC) had no information to share either. Eventually we found an article about SSW work being done by researchers from Ontario Tech University and the Scugog Lake Stewards. We were relieved to finally find someone who understood our concerns.

In the summer of 2019 we connected with the New York based Finger Lakes Partnership for Regional Invasive Species Management (PRISM) who were launching the 'Starry Stonewort Collaborative for the Great Lakes Basin'. The Collaborative's aim was to increase awareness of starry stonewort, facilitate the sharing of information and resources, and encourage research. The Project Manager for the Collaborative, David Carr, shared research we hadn't seen and told us about the SSW monitoring program they were launching in 2020. He was happy to accept participants from Ontario into the project and would supply the training and materials needed.

I approached the Kawartha Lake Stewards Association (KLSA) about running a pilot starry stonewort monitoring project and they agreed. In June of 2020, 18 volunteers from nine lakes attended the virtual training presented by the Starry Stonewort Collaborative. The training covered the impact of invasive species, spread prevention, the importance of early detection, survey protocols and instructions on SSW identification. Nine volunteers from six lakes agreed to continue with the project and do bi-weekly aquatic plant sampling on their lakes from July until October. Each volunteer then sorted the plant material, tried to identify as many species as possible and determine if there was any starry stonewort in the sample. The app Survey123 was used to record the results of the sampling. The pilot project proved to be popular with volunteers because it gave them the opportunity to learn more about both native and invasive aquatic plants. It was also easy to do and didn't require a lot of equipment or a large time commitment.

Left: **Community scientists Jill Hamilton and Patty MacDonald sort aquatic plants from a rake toss sample on Lake Scugog**

In summer 2021 KLSA decided to continue the project with a number of exciting changes. The first change was that KLSA's project grew from nine volunteers on six lakes to 20 volunteers on 11 lakes. KLSA was also fortunate to partner with Kawartha Conservation. Brett Tregunno, an aquatic biologist with Kawartha Conservation and KLSA Director, participated in the pilot project in 2020 and thought SSW monitoring would be a good addition to Kawartha Conservation's Nearshore Monitoring Project. This meant an additional 60 volunteers with eyes on their shorelines looking for SSW. KLSA and Kawartha Conservation were able to share both training and resources. Kawartha Conservation also acquired the necessary research permit from Trent-Severn Waterway.

In 2020, all data collected was entered into the app Survey123. The Starry Stonewort Collaborative received the data and then shared it with databases such as USGS-NAS and iMapinvasives. The Collaborative also shared the data with ISAP. In Ontario, invasive species are officially tracked using the 'Early Detection and Distribution Mapping System' (EDDMapS) but in the summer of 2020 starry stonewort had not yet been added to the system. Fortunately, that changed by the summer of 2021. Brook Schryer at ISAP worked diligently with EDDMapS developers to make sure starry stonewort was listed, included species information, and would be available on the mobile app. In 2021 volunteers could enter their data directly into EDDMapS.

Making a Difference: The Evolution of Starry Stonewort Monitoring

Above: **Community scientist Doug Dewar throwing his sampling rake on Big Bald Lake**

2021 also saw the development of more Ontario-focused volunteer training. All of the training for our 2020 pilot project had been done by the Starry Stonewort Collaborative based in New York. In 2021 the Collaborative partnered with Brook Schryer from ISAP who trained volunteers on the use of EDDMapS. Biologist Dr. Tyler Harrow-Lyle from Ontario Tech University (OTU) provided starry stonewort identification training tailored to Ontario participants. Dr. Harrow-Lyle and Dr. Andrea Kirkwood from OTU also developed an identification guide for volunteers and set up an email address for volunteers to submit questions or photos for verification. They also developed a voucher sample protocol for volunteers to use if they found starry stonewort, adding another means of verifying our data. This was important because Ontario has a number of native charophytes that are easily confused with starry stonewort.

As our new program got underway we faced a few challenges. First, it became clear that proper identification was going to be a challenge for our volunteers. Due to COVID-19 the program training was completely virtual. This meant volunteers were not able to look at, or examine actual samples of starry stonewort. Many volunteers were also unfamiliar with native aquatic species so found the task of identifying a tricky species like starry stonewort even more difficult. Fortunately, the researchers at OTU volunteered to work with ISAP to verify starry stonewort submissions to EDDMapS. This prevented incorrect or questionable data from appearing on the EDDMapS species distribution map.

The EDDMapS app also proved to be less user friendly for volunteers than expected. Difficulties with setting up accounts, logging in, and submitting data were common. Some functions of the app did not work properly. Volunteers were asked to enter both positive and negative results of their rake toss sampling but discovered that 'negative' results could not be uploaded. Thankfully, ISAP was able to work with the app developers to solve this issue. Another issue was that some volunteers did not understand EDDMapS' requirements for acceptance of a positive submission. Many people forgot to include clear photographs which meant their report could not be verified. The challenges experienced in the first year of our program point to areas we will need to focus on in future training sessions. We hope that future training will be able to include an in-person component. Volunteers would definitely find identifying starry stonewort easier if they could actually see and touch some.

Although the monitoring program faced some challenges, the positive results far outweighed the negative. In the last two years, KLSA SSW monitoring volunteers have taken approximately 225 aquatic plant samples on Stony, Lovesick, Katchewanooka, Upper and Lower Buckhorn, Sandy, Clear, Chemong, Chandos, Jack and Canal Lakes, and Nogies Creek. Fortunately, the majority of those samples did not contain starry stonewort but some new areas of infestation were identified in both Lower and Upper Stoney, Lower Buckhorn and Chemong Lake. Significantly, in 2021 community scientist Doug Dewar identified starry stonewort in Big Bald Lake for the first time.

Early detection and mapping the spread of starry stonewort in Ontario are important but are not the

Above: **Community scientist Doug Dewar takes an aquatic plant sample on Big Bald Lake**

Making a Difference: The Evolution of Starry Stonewort Monitoring

Above: **Community scientist David Sutton assists with sampling from the shore**

only benefits of the monitoring program. It also helps promote a change in attitude toward our native aquatic plants and a better understanding of their role. Many people feel aquatic plants are a nuisance they'd like to get rid of. As Dr. Eric Sager pointed out in his article "Aquatic Plants and the KLSA - Love 'em As They are Both Here to Stay," in the 2020 KLSA Annual Lake Water Quality Report, aquatic plants play an important role in maintaining a resilient and healthy ecosystem. They sequester nutrients, filter suspended sediments, protect shorelines and provide important habitat for fish and wildlife. They also provide competition for aggressive invasive species like starry stonewort. Program volunteers are asked to try to identify as many aquatic species as possible in their rake samples. Frequently this is the first time they've looked closely at the plants in their lakes and attempted to identify them. Volunteer feedback indicated this was one of people's favourite parts of the project. By encouraging people to learn about our native aquatic plants and their role in the lake ecosystem, perhaps over time we'll start to see aquatic plants as friends, not foes.

The most significant impact of the monitoring program has been a dramatic increase in public awareness of starry stonewort and the importance of invasive species spread prevention. In the last two years, 102 individuals participated in monitoring program training in the Kawartha area. Although not all went on to take part in the actual sampling, they learned about starry stonewort and its potential impacts. People started talking about starry stonewort and the work being done by the Collaborative with others in their lake communities. When the Collaborative launched an educational webinar series in 2020, David Carr was astonished by how many people from the Kawartha area attended the webinars. KLSA has also been invited to speak to lake associations and lake groups about SSW and our program. Starry stonewort is now regularly mentioned during presentations by Ontario invasive species groups and the establishment of the monitoring program also helped encourage the addition of starry stonewort to EDDMapS. Public awareness of starry stonewort in the Kawarthas and a recognition of the potential economic impacts of invasive species in general is motivating the Township of North Kawartha to look for a way to support lake associations in their efforts to reduce the spread of invasive species from lake to lake. They are currently considering creating a municipal grant program to support the establishment of boat wash stations in North Kawartha. Municipal involvement in efforts to reduce the spread of aquatic invasives in the Kawarthas is a tremendous step forward. It is hoped that other townships will follow suit.

KLSA's monitoring program allows us to connect lakes dealing with starry stonewort to researchers, resources, and support from other lakes. KLSA is part of the Starry Stonewort Partners group formed in 2021. David Carr from the SSW Collaborative connected KLSA with Dr. Amanda Tracey from the Nature Conservancy of Canada and Dr. Brian Ginn from Lake Simcoe Conservation. The result was the creation of an Ontario-based group to share research, encourage cooperation between invasive species groups, and facilitate the sharing of ideas and resources between lakes. With the conclusion of the Starry Stonewort Collaborative's funding grant in 2021, this Ontario group approach has become even more important. When starry stonewort was identified on Big Bald Lake, KLSA was able to reach out to the lake association and invite them to join the SSW Partners. We were able to share signage and suggestions from other lakes, point to Ontario-based research, and programs such as the ISAP watercraft stewards. Most importantly, we were able to let them know that other lakes are dealing with the same issue. We've come a long way since 2018.

Photos by: Carol Cole

Making a Difference: The Evolution of Starry Stonewort Monitoring

Starry Stonewort Identification Guide

Prepared by: Shelby Ravary, Tyler J. Harrow-Lyle, and Dr. Andrea E. Kirkwood

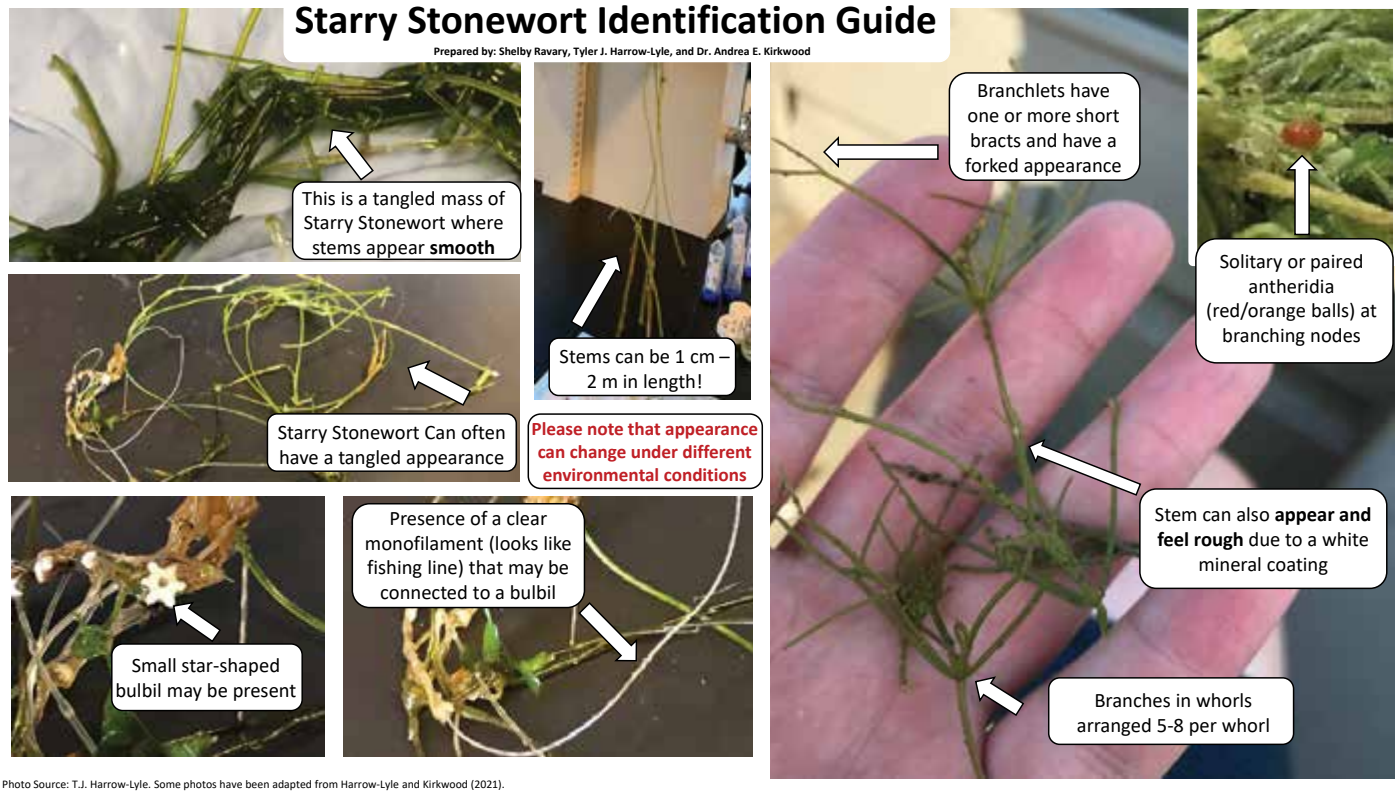


Photo Source: T.J. Harrow-Lyle. Some photos have been adapted from Harrow-Lyle and Kirkwood (2021).

Starry Stonewort Identification Checklist

You likely have a Starry Stonewort specimen if you can check all of the following boxes:

- ❑ Specimen is one of the following colours: **bright green**, **yellow**, **brown**, or **black**
  - Note: Colour varies according to environmental conditions
- ❑ Stems are smooth or rough
- ❑ Specimen with multiple stems has a messy or tangled appearance
- ❑ No noticeable odour
- ❑ Irregular whorled branches ranging from 5-8 branches at each whorl segment
- ❑ Antheridia (small red balls) present on branches
  - Small red balls **may not be present** so their absence does not disqualify your sample from being Starry Stonewort
- ❑ Star-shaped bulbils
  - bulbils **may not be present** so their absence does not disqualify your sample from being Starry Stonewort
- ❑ Clear monofilament (like fishing line) at the base of each stem

Photo Source: T.J. Harrow-Lyle

Photo Source: T.J. Harrow-Lyle

How to Save a Sample for Verification

We encourage all volunteers to consider sending a suspected Starry Stonewort sample to Ontario Tech University to confirm its identity. Starry Stonewort can be very delicate and/or brittle, requiring special care when preserving a sample for transport to the lab. **AVOID SQUISHING THE BRANCHES AND STEMS IF POSSIBLE**.

A specimen sample can be **a portion of stem with whorls and branches**, it can also consist of a **stem and bulbil (if present)**.

Steps for preparing your sample for mailing:

- ❑ Before you prepare the sample for shipment, take photos prior to washing and freezing
  - Photos of a **tangled mass** and **individual stems and branches** are especially important. You will email digital photos to the email address provided below.
- ❑ Rinse any dirt or debris off of the specimen sample, and ensure other entangled plants are removed.
- ❑ Allow to air dry for 30-60 minutes or until fully dry.
- ❑ Gently place in a Ziplock bag, remove air, and seal.
- ❑ Place ziplock bag in a small bubble-lined envelope with your name and address and mail to Ontario Tech University (address below). For best results, we recommend expedited mail (1-3 days) if possible.

When sending a specimen, please complete the following steps:

1. Complete this digital submission form: https://forms.gle/TLdwhmSfdk33oTVE8
2. E-mail digital photos to this email address: **StarryStonewortID@gmail.com**
3. Mail specimen to this address:
   Ontario Tech University
   2000 Simcoe St.N.
   Oshawa, ON L1G 0C5
   Attention: Andrea Kirkwood, Faculty of Science

My Volunteering Story - NO REGRETS

Barbara Karthein,
Volunteer, Scugog Lake Stewards

My belief is that life can be well-lived in these challenging environmental times if you have an inquiring mind and enjoy learning. If, in addition to being curious, you enjoy meeting like-minded people and feeling that you are making a useful difference, then I would suggest that you get involved with your local Lake Stewards' association. Making a positive difference about important issues of your environment on your own is difficult. Working with great partners is the way to go.

As a newly retired, relative newcomer to the Scugog community in 1999, it was immediately rewarding to get involved as one of the founders of the Scugog Lake Stewards. Its mission was and continues to be -- to "sustain and enhance the health of Lake Scugog and its watershed through the promotion of projects, research, education and community stewardship." www.scugoglakestewards.com.

If you volunteer one summer to do testing or to do a day's tree planting, that is very important for a lake stewards' organization, but for your own personal growth and feeling of satisfaction, I would suggest a more in-depth, longer-term commitment. In my case, I think you will agree that as one of the initial group of Scugog Lake Stewards, I should feel satisfaction in seeing the before and after pictures of the first Scugog Lake Stewards' project as it has matured: Joe Fowler and Baagwating Parks just south of Palmer Park in Port Perry. The impetus for this work was to help inform shoreline owners about creating good shoreline habitat both for the health of the lake and their property's benefit. With the chosen narrow, eroding lake edge area, the Stewards constructed two shoreline parks to demonstrate seven different erosion control techniques and the beauty and variety of good shoreline naturalization. It is now a very popular walking area.

From there, the group tackled a wide range of issues affecting the Lake; always with community education and lake improvement at their core: private septic systems, a new wastewater treatment plant

Joe Fowler Park shoreline before erosion protection and naturalization

Joe Fowler Park in 2021, showing growth and well used trail

After improvement to Baagwating Park stormwater channel and naturalization, showing Lishman Bridge

for Port Perry, fluctuating water levels in the lake, stormwater mitigation, lake water quality, invasive species, fish studies and researching aquatic plants and algae. These two latter on-lake studies led to discovering the first of the new, very troublesome macroalga starry stonewort, (*Nitellopsis obtusa*) in Lake Scugog in 2015.

With a generous 3-year grant from the Ontario Trillium Foundation, we carried out what has turned out to be leading-edge studies on the spread and nature of starry stonewort and water quality. This was done by researchers from Ontario Tech University and other partners and led to many papers published in scientific publications, as well as more than 45 YouTube videos. https://scugoglakestewards.com/research/

I mention the breadth of our work to indicate that for anyone considering volunteering with a local

My Volunteering Story - NO REGRETS

stewards' group, there is always a wide-open field of valuable work to be done and not enough committed people to do it. There would probably be a niche for you whether that be in the field of research or projects, communications and technology, financial help, event or membership organizing, scientific skills, fundraising, or any other talent or interest. There is always a place for curious, willing hands.

We all come into these organizations without knowing the big picture and sometimes we hold beliefs that we later find are a bit misguided or impossible; but everyone has something to offer if they are willing to learn and do, or whether they have a lot of time and energy to offer or not.

In my case, my opportunity was presented at the perfect time following retirement. Working with the Scugog Lake Stewards for over 23 years, there have been successes and some frustrations but the work was always fun because of having great friendships and constant learning and challenges. Therefore, I now challenge you to get involved. Find a topic that's yours and help us to help our environmental future.

Photos: Barbara Karthein

Stoney Lake Stillness **Photo by: Ward Strickland**

Shoreline habitat **Photo by: Dave Trant**

Stoney and Clear Lake Shoreline Assessment and Mapping Project

Roz Moore, *Chair, Environment Council for Clear, Stoney and White Lakes*
Thom Unrau, *Director of Community Conservation, Kawartha Land Trust*

The Environment Council for Clear, Stoney and White Lakes in partnership with the Kawartha Land Trust welcomed three Fleming College students majoring in GIS (Geographic Information Systems) to participate in our shoreline assessment and mapping project this past spring and fall, 2021. Their technical contributions and overall engagement in the project were impressive and most appreciated. We were also fortunate to have technical support and consultation for the students provided by Silvia Strobl and Steve Voros, GIS specialists at the Ministry of Natural Resources and Forestry, and Tammy Sikma, Director of the Peterborough County GIS department. Finally, we were pleased to have additional student and community support for data collection.

Project goals

The project was launched to address the need for current, reliable data and mapping to support Environment Council education and advocacy work on shoreline conservation including deputations to our municipalities to request greater policy protection. The data would also provide significant mapping data support for the Kawartha Land Trust, required to identify important properties for conservation, and to engage the lake community in shoreline and shoreland protection.

Methods

The project focused on integration of satellite data and ground-truth verification of shoreline features reflecting remaining natural shoreline and altered shoreline conditions on Clear and Stoney Lakes. Satellite data was provided by provincial government sources. Verification of features was obtained by summer students in canoes collecting data at the lake shoreline. (Satellite data is limited to a vertical aerial view which is obstructed by tree and shrub canopy overhanging the lakes' shorelines. Shoreline verification provides details of natural vegetation and altered shoreline structure and function within the riparian zone.)

The first student deliverable was a Digitization Manual detailing methodology for shoreline inventory on Stoney and Clear Lakes. The second deliverable was a mapping application featuring individual properties/parcels and their viability for conservation and protection. Viability was determined based on criteria identified in collaboration with the Environment Council and Kawartha Land Trust. These criteria included the effect of building footprint, wetland features, watercourse inlets, ecosystem connectivity features and shoreline alteration.

Study outcome and analysis

This analysis provides an accurate picture of shoreline health on the lakes. We can identify how the actions of landowners on the lake can contribute to positive outcomes for lake health, and how they can accumulate to negatively impact shorelines. Specifically, we now know that 36% of the two lakes is altered shoreline. This will allow us to work together with landowners to celebrate and protect the remaining 64% of their natural shoreline.

Details of data provide insights into the state of the lake now, a baseline for future shoreline studies. Information collected in the future may then reflect the effective results of improved policy and resident management for protecting shoreline.

Parcel analysis highlights

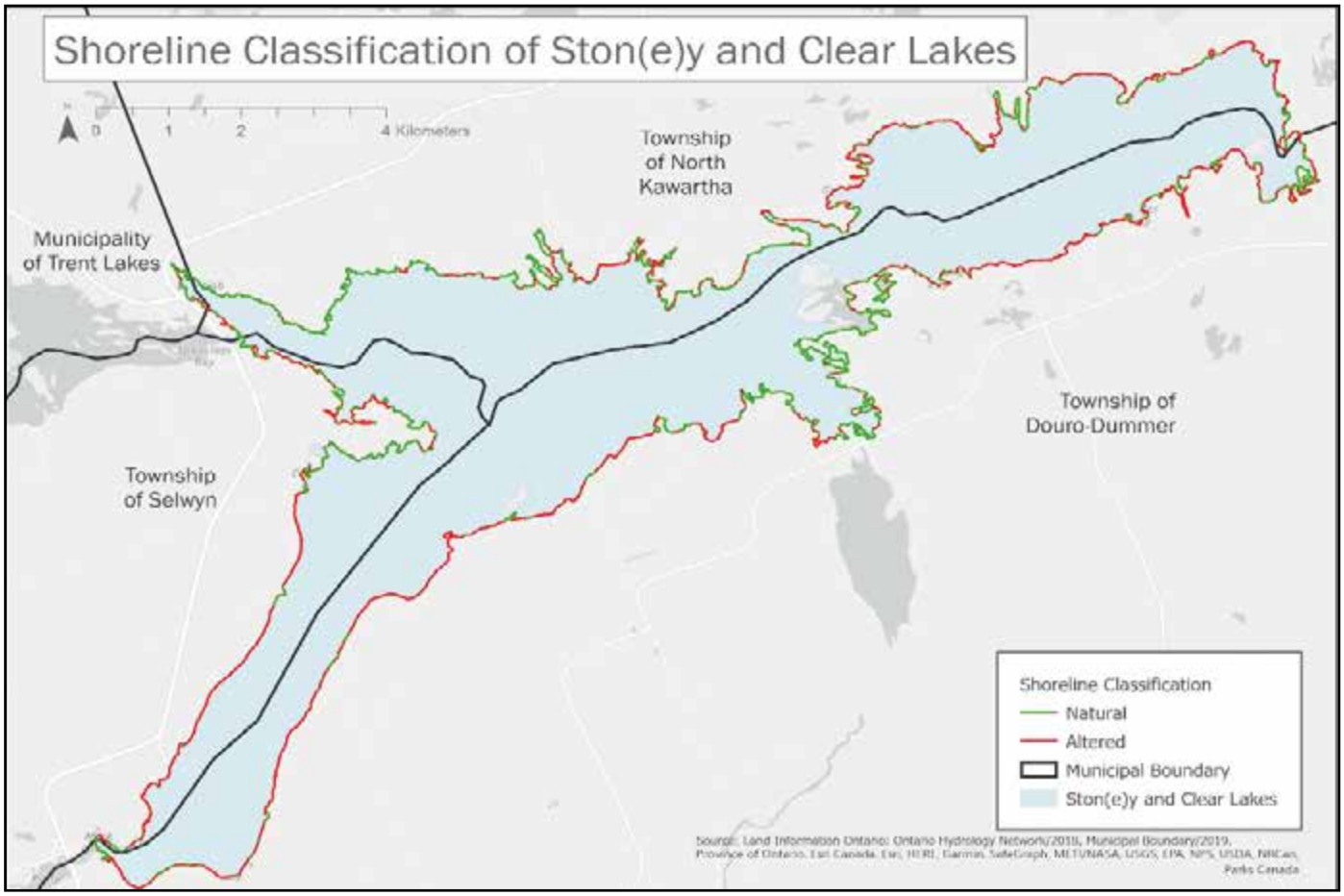
Total for Stoney and Clear Lakes combined: 114 km, 1475 parcels

- Stoney:
  - 1046 parcels, 91 km of shoreline
  - 277 parcels have 0% natural shoreline
  - 397 have <30% natural shoreline
  - Total 65 km (71%) considered natural
- Clear:
  - 429 parcels, 23 km of shoreline
  - 297 parcels have 0% natural shoreline
  - 320 have <30% natural shoreline
  - Total 8 km (38%) considered natural

Total alterations:

- 676 permanent docks
- 279 boathouses (on the water vs. on land with a ramp)
- 10 marinas
- 120 boat ramps

Stoney and Clear Lake Shoreline Assessment and Mapping Project

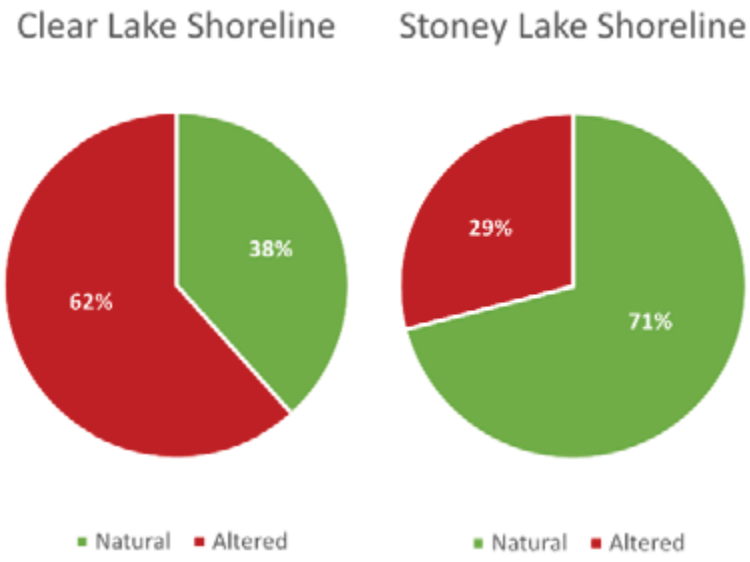


- Most altered shoreline is in the form of revetment (retaining wall): 33.0 km
  - Compared to 7.9 km of lawn, 0.8 km of boat launch
- 52.1% of lawn (4.1 km of 7.9 km) was considered to be eroding
  - Compared to 11.6% of shoreline with vegetation, 3.6% of shoreline with revetment, 0.9% marsh shoreline

Benefits of protecting shoreline vegetation

Maintaining or restoring shoreline vegetation can provide the following:

- Erosion control
  - Roots hold soil in place
  - Leaves reduce impact of rain/ waves on soil surface



- Flooding reduction
    - Vegetation slows the movement of surface water, allowing more to be absorbed into the ground instead of running into the lake and raising water levels
- Shade
    - Relief in the summer for humans and wildlife, decreases water temperature
    - Higher water retention by soil

Shoreline vegetation **can provide a buffer** to some negative impacts on shoreline, water quality and habitat, including:

- Pollution reduction
    - Lawn and retaining walls allow pollutants (e.g., fertilizers, pesticides, road salt, vehicle fluids, sediments) to flow directly into water
- Reduction of shoreline hardening and toxicity of materials provides better protection of wildlife and marine animals' habitat and biodiversity
- Wind break
    - Vegetation can reduce cost of heating in winter, as well as noise and dust

Benefits of natural shoreline to wildlife

- Broadly: provide shelter, food, water, travel corridors
- Fish use submergent plants for cover
- Dragonflies and damselflies use floating/submerged vegetation to lay eggs, and to sit and watch for prey
- Amphibians lay eggs on submerged vegetation
- Turtles use the shore for nesting, fallen trees for basking
- Many mammals (e.g., muskrat, otter) inhabit burrows in the shore
- Beavers need young trees to build their lodges
- Native riparian plants attract butterflies and birds, such as:
    - Butterflies: black-eyed susan, wild bergamot, dogbane
    - Hummingbirds: spotted jewelweed, columbine
    - Granivorous birds: Eastern white pine, aster, sunflower
    - Frugivorous birds: staghorn sumac, common blackberry

Implementation of shoreline conservation objectives

We proposed this project as a catalyst for action.

With this information we hope to collaborate with landowners of natural shorelines to thank them for caring for overall lake health and engage interested landowners in permanent protection of these significant and threatened features. We also want to further the understanding of shoreline health for residents in the lake community by continuing to provide educational materials and training relevant to property management for conserving and restoring natural shorelines.

Restoration projects on altered shorelines will continue with residents' active interest and financial support from a variety of sources.

Sharing this study outcome with local governments will clarify the pressing need for creation of new policies and bylaws that meaningfully address conservation of remaining shorelines.

Finally, we also wish to develop and share a vision and action plan with lake community partners for forever protecting the character and environmental health of the lake through shoreline conservation.

References

1 https://loveyourlake.ca/natural-shoreline/

2 https://www.rvca.ca/media/k2/attachments/BenefitsZofZaZNaturalZShoreline.pdf

3 Restoration potential of several native species of bivalve molluscs for water quality improvement in mid-Atlantic watersheds (Kreeger, Gatenby and Bergstrom, 2018)

4 Ecological consequences of shoreline hardening: a meta-analysis (Gittman et al., 2016)

5 Ecological coastal protection: pathways to living shorelines (Moosavi, 2017)

6 Shoreline infrastructure degradation and increasing littoral naturalization accommodates juvenile fish and crab assemblages in heavily urbanized Upper New York Harbour (Grothues and Able, 2020)

7 https://www.torontozoo.com/adoptapond/UrbanOutback/part53.html

The Natural Edge Program: Restoring shorelines back to their natural beauty

Kimberly Ong,
KLSA Director

Since 2020, the Kawartha Lake Stewards Association (KLSA) has been delivering the Natural Edge Program, thanks to partnership and generous funding from Watersheds Canada. In 2021, eleven shorelines were restored on Lovesick, Big Cedar, Sturgeon, Big Bald, Upper Stoney, and White Lakes. At least four more sites will be planted in Spring 2022 (with hopefully more in the future, pending funding!).

Shorelines are known as the 'ribbon of life', providing shelter, food, protection, and much more to our land-based and aquatic species. When the water's edge is naturalized with native ground cover, wildflowers, shrubs, and trees, there are many benefits. In its natural state, shorelines can defend against erosion because roots hold soil in place, helping resist wave action and the impact of rainwater. In addition, natural shorelines filter harmful chemicals that run off into the lake, preventing drastic alterations in water chemistry and potential algal blooms. Vegetated buffer along a shoreline can help keep pesky geese off the property, bring in the butterflies, bees, and other pollinators, and, once established, save time because they require little upkeep (no mowing)! The goal of the Natural Edge program is to restore disturbed or altered shorelines back to a more natural state to realize all these benefits.

The program is available to waterfront property owners in the Kawartha Lakes region. If you're eligible for the program, an expert from Watersheds Canada will visit your site, evaluate the conditions and discuss shoreline concerns. Then, using a specially created app, the expert designs a personalized planting plan. This plan allows landowners to visualize the restoration and includes photos of the planting areas mapping the various native plant species, as well as a description of the land characteristics of the planting area and information on each native plant, shrub, and tree chosen for the planting. Finally, the plants are ordered on the landowner's behalf, and KLSA volunteers will pick up the plants and deliver them directly to the property! Watersheds Canada also provides planting materials

Figure 1. **An example of the personalized planting plan**

Chloe Lajoie from Watersheds Canada performs the site visits and evaluates the land.

like soil, mulch, cocomats, and tree guards to help the plants take root, and materials such as shoreline care guides. KLSA even brings extra volunteers to help with the planting, if you'd like us to help! The cost to each owner is $250 to help offset the plant costs. Typically, it takes about three years for the plants to fully establish and fill in the shoreline.

The Natural Edge Program: Restoring shorelines back to their natural beauty

Volunteers help restore the shoreline with native plants and shrubs. The brown mats ('cocomats') protect the new plants and will eventually biodegrade.

This year we welcomed the wonderful support of the Environment Council (and its funding support from the Stony Lake Heritage Foundation), who assisted KLSA in delivering the plantings on Ston(e)y, Clear, and White lakes. Funding support for the Natural Edge Program has been provided by the Daniel and

Lois Wallace of the Environment Council helps organize the plants, in preparation for delivery to landowners.

Susan Gottlieb Foundation and the RBC Foundation 'RBC Tech for Nature Fund'. Chloe Lajoie of Watersheds Canada continues to provide the expertise and support to help us deliver the program. We were also lucky to have many volunteers from the local community and schools helping plant this year - thank you to all of you, you were instrumental to the success of this program!

If you're interested in turning your shoreline into a naturally beautiful, cost-effective, ecologically responsible ribbon of life, please contact kim.ong@klsa.info. We hope to continue the program but await funding support for the program.

Photos by: Kimberly Ong

Geese on Big Bald Lake **Photo by: Nancy Boyce**

Buckhorn Yacht Harbour on Upper Buckhorn Lake
Photo by: Pat Lofthouse

Volunteer Powered Stewardship: Keep Big (Boyd/ Chiminis) Island's Shore Clean

Patricia Wilson, *KLT Community Conservation Coordinator*
Hayden Wilson, *KLT Land Stewardship Coordinator*

Kawartha Land Trust (KLT) has been working to protect our natural lands right here in our own backyards (over 4,500 acres and counting) for more than two decades as a registered charity and non-governmental organization.

It should come as no surprise that the support from our vibrant Kawartha communities has been our strongest pillar in the success of our organization. We are constantly impressed by the generosity of our donors, volunteers and landowners in helping us work towards our ambitious land acquisition goals.

Our donors, volunteers and supporters are the heart and soul of our organization - without their passion and hardworking nature we could not protect and properly steward the unique lands that are entrusted to us. These past couple of years have been particularly difficult for us as we have not had the same opportunities to connect and engage with our friends and neighbours out on the lands and waters that we love. Despite pandemic-related setbacks, we still managed to get a few nice days of sunshine, socially-distanced stewardship and stories to share.

Those of you who live along the lakes and rivers of the Kawarthas know firsthand the amazing benefits these lands and waterways provide. One of our most popular protected areas for lakeside leisure is Big (Boyd/Chiminis) Island, situated at the north end of Pigeon Lake, adjacent to Bobcaygeon. Most of the Island was donated to KLT in 2015, with some remaining parcels officially donated in 2021. Like other KLT protected properties, the island has a trail network open for public day-use and hiking. KLT has even installed picnic tables for lakeside picnics and relaxation, and docks for easier access for boaters. Unfortunately, like most places, some people leave their garbage behind, making it unpleasant for other visitors and polluting our natural environment.

The diversity of things that wash up along the 10 km of shoreline is truly astounding. Unfortunately, the majority of objects found on our shores aren't always cool nature treasures. Plastic wrappers, chipped and sun bleached plastic bottles, aluminum cans from beach parties and a flip-flop or two (never a matching set!) are just a few of many items we find on regular visits to the island. It was brought to our attention by our team of dedicated land stewards, who help manage this 1,226-acre island, that most of the washing up and littering happens along the south shore. With that note, on September 25, 2021, an expeditionary cleanup force of 25 volunteers, KLT staff and property stewards set out to scour the southern shore and haul the trash off the island.

Kawartha Land Trust volunteers and staff with the garbage collected on the south shore of Big (Boyd/ Chiminis) Island in Pigeon Lake

As mentioned earlier, we are always impressed by how much effort our volunteers are willing to put into protection and enhancement and once again, they did not disappoint. Collectively this diligent group of volunteers helped to haul roughly 317 kgs (700 lbs.) of trash off the island! This was no easy feat, especially since many pieces needed to be dug up or were tangled up on trees and bushes along the shoreline. We even had some folks brave the choppy and windy straits on this sunny fall day! Sailing down to the far southern point of the island and around the west shore, our boating volunteers worked hard to collect floating debris like oil drums, tires, lawn chairs and anything else that could get accidentally blown off a dock or boat or abandoned by visitors. This impressive haul doesn't even take into consideration the thousands of kilograms of forestry and farming equipment (not to mention dumped garbage and couches from parties past) KLT volunteers and staff have removed from the island since it officially fell under our protection in 2015.

This story was just one of the projects made possible by our community of stewards, volunteers and supporters. If you missed this fun fall cleanup - don't

Volunteer Powered Stewardship: Keep Big (Boyd/ Chiminis) Island's Shore Clean

KLT volunteers help to transport the garbage from the Island to the mainland

panic. We have lots of big plans to engage with our beloved Kawartha community this year, which include more garbage cleanups, amongst other fun and engaging activities! We can't wait to re-connect with everyone and revive our shared connections to the land!

If you are interested in getting involved we'd love to have you on our team! Volunteers help with bio blitzes, monitoring for species at risk, invasive species management, tree planting, guided hikes and so much more.

KAWARTHA LAND TRUST
Protecting the land you love.

For more information about KLT events, properties and their permitted uses, trail maps, donating and volunteering, please visit us at kawarthalandtrust.org, or email info@kawarthalandtrust.org

Photos courtesy of KLT

Participating in the Canadian Lakes Loon Survey

Canadian Lakes LOON SURVEY

Want to monitor loons? Joining the program is easy: first contact Birds Canada at www.birdscanada.org to register. Then, pick a section of your lake that typically has loons. Seek out and record loon sightings once a month in June, July and August, and submit your data when you're finished to Birds Canada.

Exploring the Secret Lives of Fish in our Lakes

Graham Raby, *Assistant Professor in the Department of Biology, Trent University*

The project

At Trent University, we are preparing to launch a research program focused on the health of the Stoney Lake ecosystem. The goal of this program is to conduct world-class research on Ston(e)y Lake, Clear Lake, and Upper Stoney (collectively referred to as Stoney Lake hereafter) that will help protect the lakes against current and future threats, in partnership with the people and organizations who are already doing environmental monitoring work. To begin the program, we will conduct a multi-year fish tracking project that will answer important questions about fish behaviour, spawning, survival, habitat preferences, and the effects of changing water quality. This fish tracking project is the starting point for a longer-term program that will include research on the full range of threats that impact the Kawartha Lakes (e.g., invasive species, toxic algae, climate change).

How it will happen

This is a project made by possible by donations from members of the community, led by the Ingleton and Szego families of Stoney Lake who have donated the necessary funds to start the program, and who will continue their support in the years to come and assist with bringing other donors on board. We also have an exceptional partner in Dr. Jake Brownscombe from Fisheries and Oceans Canada (DFO), who will provide a major investment of time, expertise, and equipment to make this project possible (>$200,000 of in-kind support). We will also work with other government agencies and the local people and organizations who are already doing important ecosystem monitoring.

The project will involve many fish species, with a particular focus on walleye (often referred to as 'pickerel' in Ontario), an important fishery species that has declined in Stoney Lake and the Kawarthas. Acoustic telemetry will be used to track the movements of individual fish, by listening for 'tagged' fish (fish implanted with acoustic transmitters) with a network of underwater 'listening stations' (acoustic receivers). Fish tracking will be complemented by monitoring of key habitat variables like water temperature, clarity, and dissolved oxygen. We are planning on getting started this spring (2022).

Above: A walleye being released in Lake Erie after having an acoustic transmitter inserted into its body cavity. The fish is also externally marked with an orange numbered tag (behind the dorsal fin) so that it can be easily identified when recaptured in the fishery. **Photo credit: Andrew Muir.**

Right: An acoustic receiver deployed underwater in Lake Huron, similar to what the moorings will look like for the Stoney Lake fish tracking project. **Photo credit: Tom Binder.**

So what?

The fish tracking project will reveal fascinating and previously unseen fish behaviours in ways that will help engage the community in thinking about the lake as a living system. We will gather valuable information on where and when fish spawn, estimate their survival rates, identify crucial summer foraging and over-wintering areas, and help understand the impacts of threats like changing water quality.

Support the next generation of freshwater biologists

While my name appears on the byline of this article, future updates will celebrate the achievements of the undergraduate and graduate students at Trent helping to carry out this research. The research will not only produce valuable information but will also help train the next generation of freshwater biologists who, in the process, will become deeply engaged with the Stoney Lake ecosystem and surrounding community.

The program would benefit greatly from additional donations to support the personnel costs (undergraduate and graduate students at Trent University) to run the fish tracking project over the coming years, and to fund the purchase of acoustic transmitters (tags to track fish). If you are interested in donat-

ing, please get in touch with Emily Vassiliadis (emilyvassiliadis@trentu.ca) at the Trent University Advancement Office.

Stay tuned

We are excited for his project to begin and to connect with the community. Stay tuned for more updates. To learn more about Graham Raby's Integrative Fish Ecology Lab, visit www.rabylab.com.

Buckhorn Yacht Harbour on Upper Buckhorn Lake
Photo by: Pat Lofthouse

Deer Bay off Lower Buckhorn Lake
Photo by: Abigail Phillippe

Deer Bay off Lower Buckhorn Lake
Photo by: Abigail Phillippe

E. coli Bacteria 2021 Testing Results

Mike Dolbey, *KLSA Director*

Kawartha Lake Stewards Association (KLSA) volunteer testers were out on 13 Kawartha lakes during the summer of 2021, collecting water samples at 81 sites, 4 to 6 times over the course of the summer. We were pleased to welcome back many volunteer testers on Balsam Lake thanks to the organization by KLSA Director, C. Lee. Thank you, volunteers, for your dedication and hard work. All readings are recorded in Appendix E.

Other than the 12 new sites on Balsam Lake, sampling locations were similar to those in the past few years, and results were also very similar. Our lakes show low bacterial counts, with the large majority being less than 20 *E. coli* cfu/100 mL (see chart below). These generally low counts indicate good shoreline management. Elevated counts occurred at sites where they have occurred in previous years. This is usually where waterfowl congregate, often along grassy shorelines. KLSA recommends keeping a 'buffer zone' of natural vegetation along your shoreline both as a deterrent to geese and to reduce erosion and runoff.

For a long-term overview of the KLSA *E. coli* testing program, please see *KLSA's E. coli Testing Program: Analysis of Results 2001 – 2017* in the 2017 KLSA Annual Report.

KLSA would like to have bacteria testing on the more western Kawartha lakes. All that is needed is a few volunteers, plus a coordinator who is willing to transport samples to the SGS laboratory in Lakefield. **Please let us know if you are on Sturgeon or Cameron Lakes and are interested in participating in this important program. If you would like to test a location of your choice on your lake, please let KLSA know**. There is an excellent instructional video about bacteria testing on our website in the 'Publications' section if you would like to see what is involved. For more information or if you are interested in sampling in 2022, contact C. Lee, KLSA Coordinator for the *E. coli* program at lee@klsa.info.

Year	Number of *E. coli* Readings (cfu/100 mL)				
	Total	0-20	21-50	51-100	Over 100
2021	443	397	38	7	1
2020	383	357	22	3	1
2019	378	356	16	4	2
2018	376	347	23	6	0
2017	352	324	16	6	6

Fall Splendor, Buckhorn Lake **Photo by: Dave Trant**

Pigeon Lake Reflections **Photo by: Ann Gronow**

Lake Partner Program 2020 Testing Results
Total Phosphorus, Secchi Depth and Calcium

Mike Dolbey, *KLSA Director*

C. Lee, *KLSA Director*

Our Lake Partner Program (LPP) report is one year behind (2020) because the provincial data for the year 2021 were not available to us before going to press.

Why measure phosphorus levels in lake water?

Phosphorus is regarded as the chemical that is most responsible for increased plant and algal growth in freshwater lakes. Sources of phosphorus include shoreline erosion, fertilizers, wildlife, septic systems, sewage treatment plants and pets. Limited fertilizer use and a well-vegetated shoreline are good ways to limit your phosphorus input and keep our lakes clear. The Ontario Ministry of the Environment, Conservation and Parks issued the following guidelines for total phosphorus (TP) in our lakes:

• To avoid nuisance concentrations of algae in lakes, average total phosphorus concentrations for the ice-free period should not exceed 20 µg/L (equal to 20 parts per billion, ppb).

• A high level of protection against aesthetic deterioration will be provided by a total phosphorus concentration for the ice-free period of 10 µg/L or less.

2020 Phosphorus testing results

2020, KLSA's twentieth year of water quality testing, was like no other. Due to the COVID-19 pandemic, the Dorset Environmental Sciences Centre (DESC) was closed in March 2020 and the Lake Partner Program (LPP) was temporarily suspended. However, the notice of the suspension was issued by the Federation of Ontario Cottagers' Associations (FOCA) and not directly to LPP volunteer testers. Volunteers who did not hear about the suspension continued to collect samples and send them in. These samples were received and analyzed by LPP. The suspension was lifted late in 2020 and volunteers were asked by LPP to collect an October sample and to send in any Secchi measurements that may have been collected during the year. Because of these circumstances, the 2020 Total Phosphorus, Secchi Depth and Calcium data sets for the Kawartha Lakes are much smaller than usual.

Thank you to all our volunteer testers who were able to collect samples and measurements in 2020. The LPP program was fully reinstituted in 2021 and we encourage all LPP volunteers to continue testing to extend the value of these long-term data sets. If you are unable to continue testing, please let any director in KLSA know, so we can help you find a replacement. The program is free, and kits are mailed to you along with instructions. We have fairly complete coverage of the Kawartha Lakes, but many volunteers would welcome an assistant. **Also, we are looking for a tester for south Sturgeon Lake and for the middle of Chemong Lake. Please let us know if you are interested.**

In 2020, total phosphorus (TP) was measured at 20 sites on 11 lakes, most only in October but at seven of the sites, four to six times samples were collected between May and October. Samples were analyzed by the Ministry of the Environment, Conservation and Parks' Lake Partner Program. The TP data for hundreds of LPP sites on Ontario lakes can be found on the Federation of Ontario Cottagers' Associations (FOCA) website or in the Province of Ontario's Data Catalogue.

2020 started with a snowy January, but moderate temperatures and little snow through the rest of the winter resulted in an early and modest spring flood. A wet May was followed by a very dry, hot June resulting in higher-than-normal lake water temperatures. Due to COVID-19 pandemic restrictions, the Trent-Severn Waterway remained closed and fewer people visited our lakes. How did these factors affect TP concentrations in our lakes in 2020 compared to previous years? We wish we could tell you, but unfortunately there is not enough data to allow meaningful comparisons to be made as in past years.

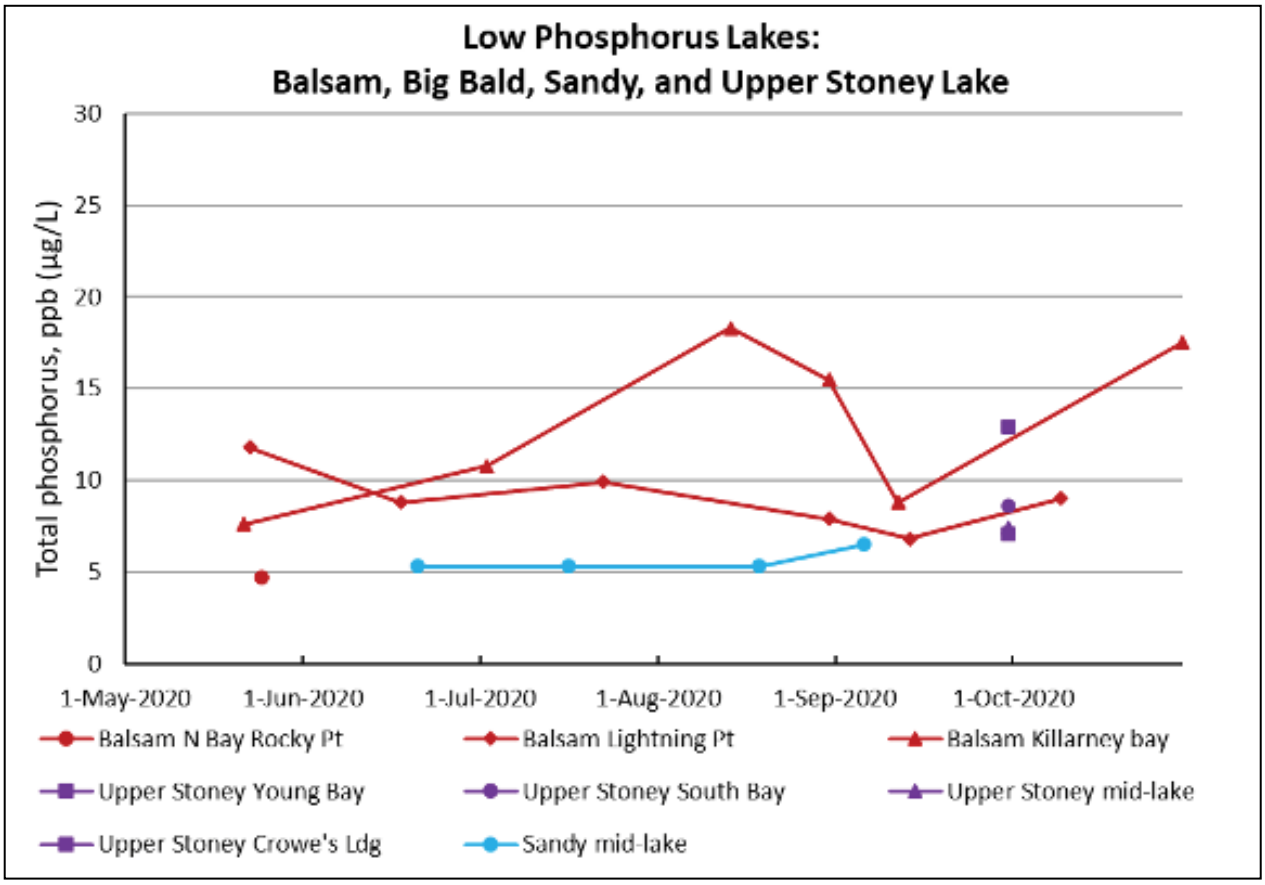
Lake to lake phosphorus results

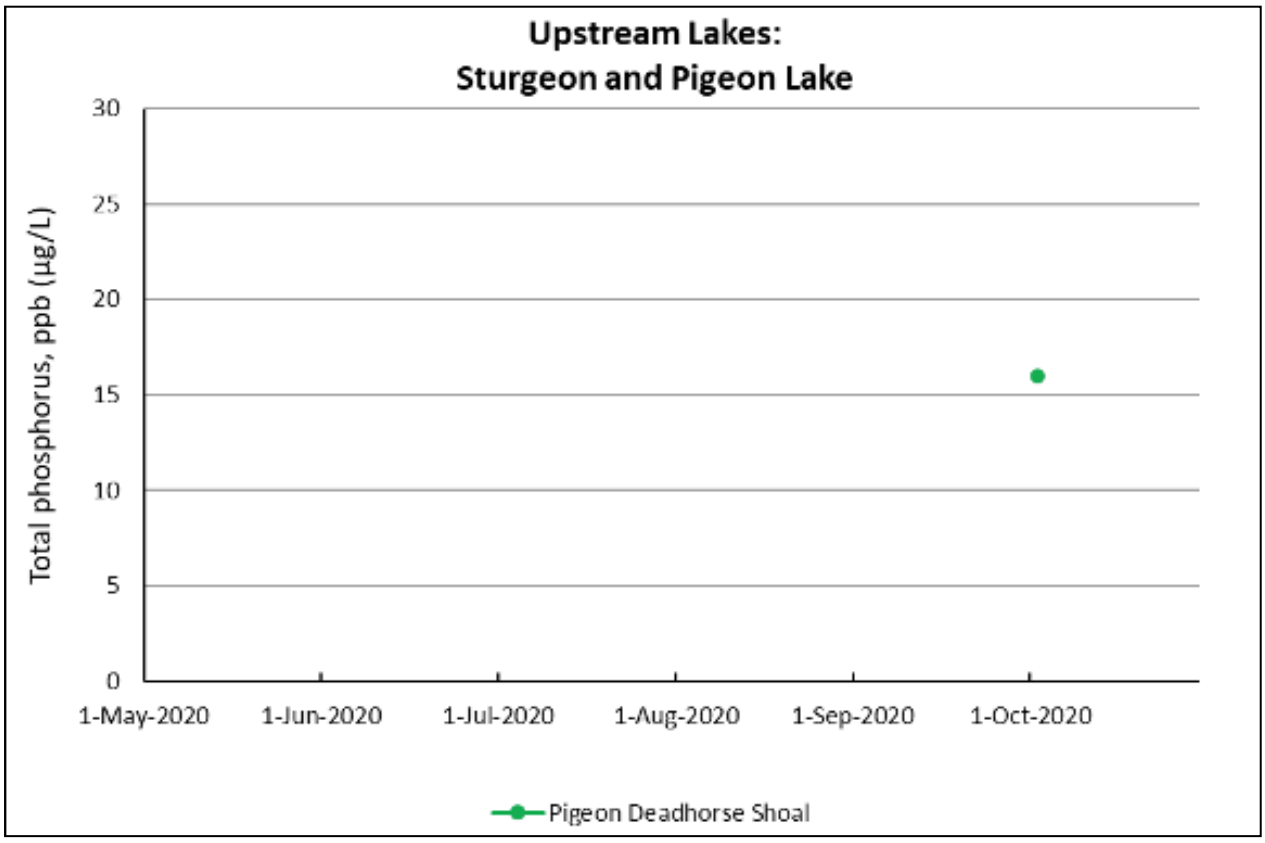
The complete tables of TP measurements, Secchi depths and Calcium levels are presented in Appendix F. In general, the results were similar to results from previous years. For consistency with past years, we present the results in graphical form grouped by the type of lake, low phosphorus lakes, upstream lakes, midstream lakes and downstream lakes.

Low Phosphorus Lakes

The low phosphorus lakes traditionally have low, stable TP levels, being fed with low phosphorus water from the north. The high readings in 2020 at Balsam Lake's South Bay/Killarney Bay site are unusual.

Lake Partner Program 2020 Testing Results
Total Phosphorus, Secchi Depth and Calcium





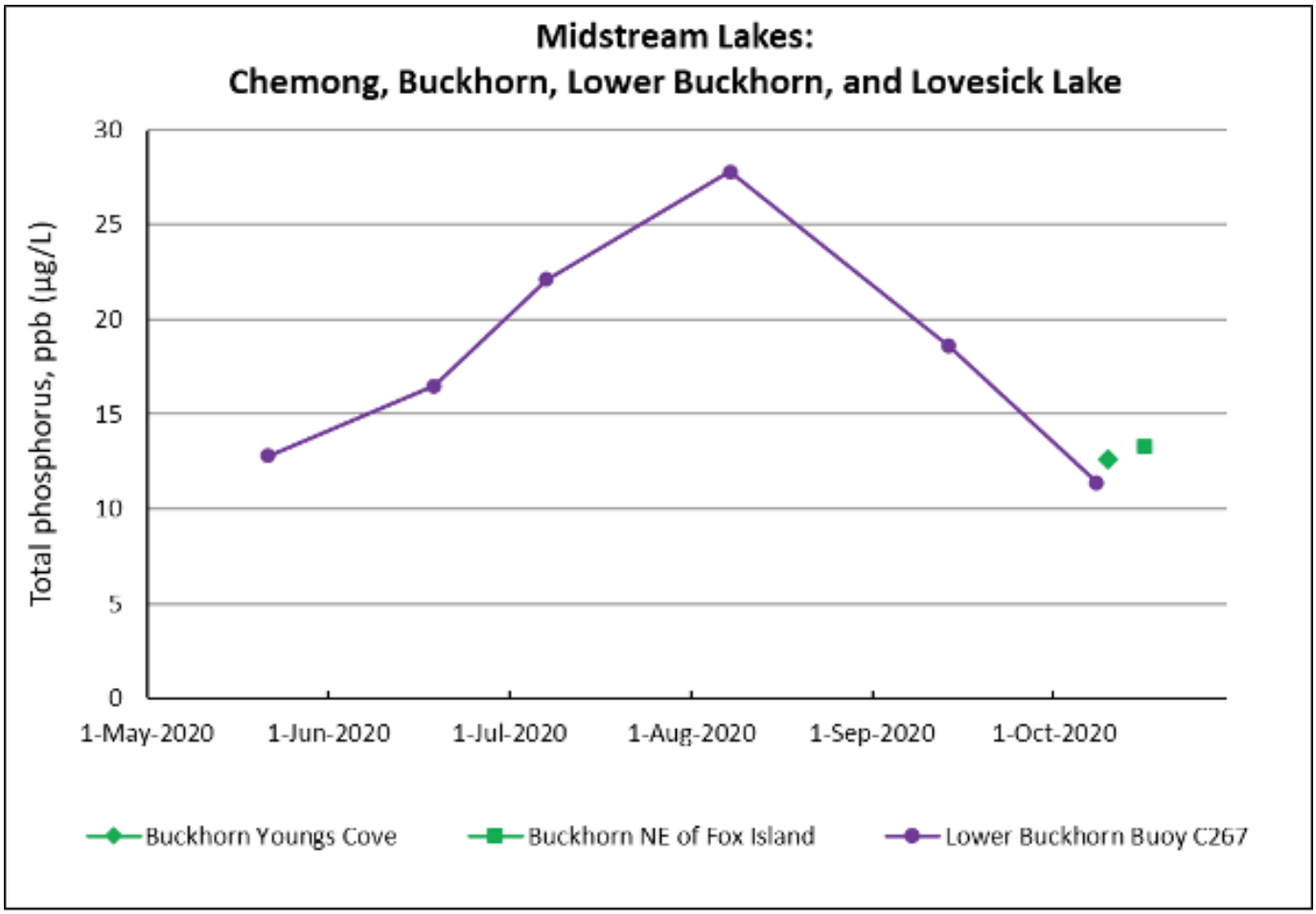
Lake Partner Program 2020 Testing Results
Total Phosphorus, Secchi Depth and Calcium

Upstream Lakes

Sturgeon Lake receives low phosphorus water from the Fenelon River to the north and high phosphorus water from the Scugog River to the south. Pigeon Lake receives water from Sturgeon Lake moderated by lesser inflows from the Bald Lakes and Nogies Creek to the north and the Pigeon River to the south. Only one site was measured once in October on these lakes in 2020.

Midstream Lakes

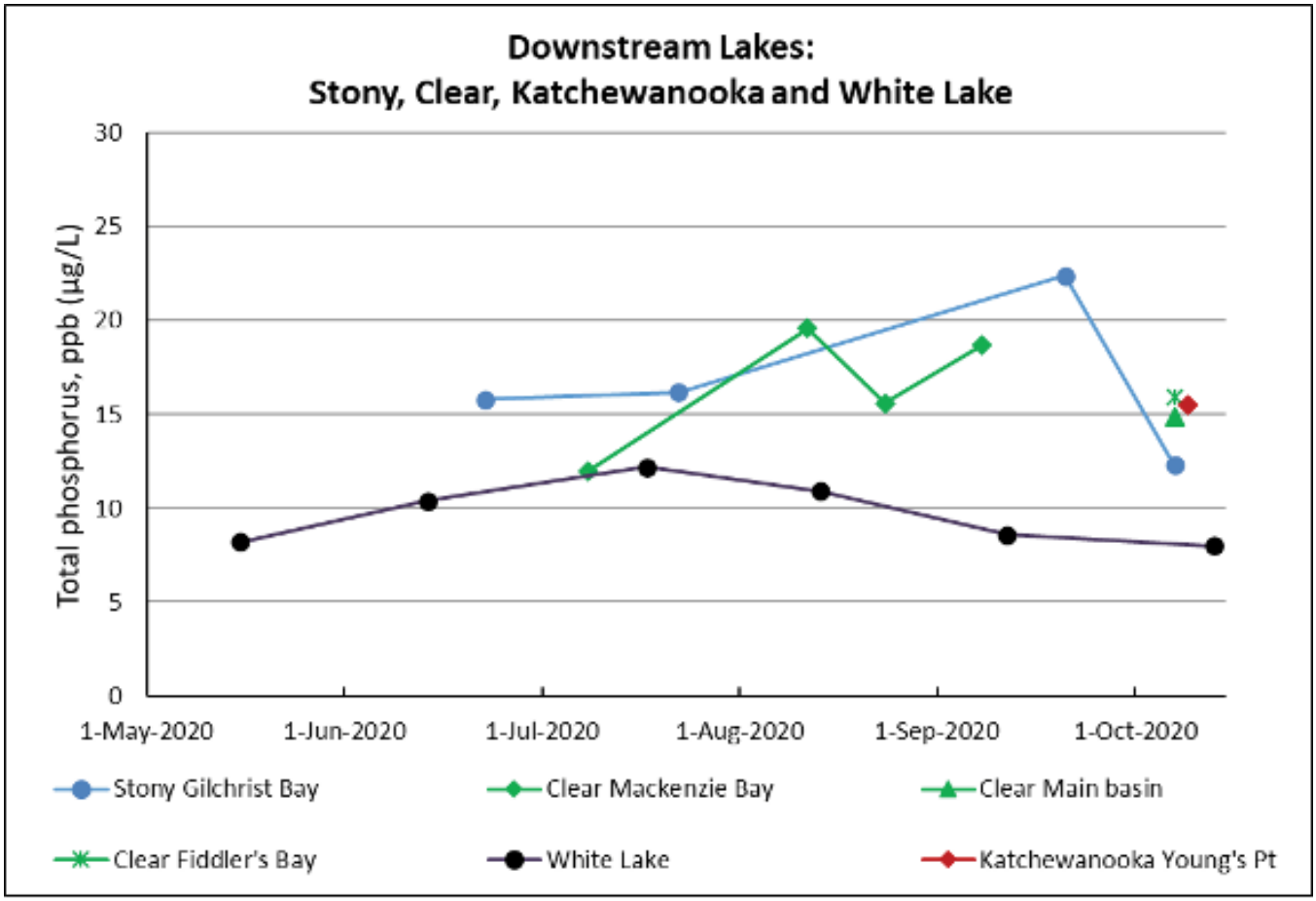
Of ten sites usually measured on these lakes, only one was sampled throughout 2020 and two more in October only.



Lake Partner Program 2020 Testing Results
Total Phosphorus, Secchi Depth and Calcium

Downstream Lakes

Higher phosphorus water flowing into Stony Lake from the midstream lakes is diluted with low phosphorus water from Upper Stoney Lake resulting in moderate levels of phosphorus in Clear and Katchewanooka Lakes. White Lake receives water from Stony Lake's Gilchrist Bay via the Indian River. However, its phosphorus levels are generally lower than Stony Lake, believed to be due to the presence of springs in White Lake.



Stoney Lake Serenity
Photo by: Ward Strickland

Misty morning loon, Buckhorn Lake
Photo by: Douglas Burrell

2020 Kawartha Lakes Sewage Treatment Plants Report

Mike Dolbey, *Ph.D., P.Eng., KLSA Director*

Each year, KLSA monitors the performance of Sewage Treatment Plants (STPs) that discharge effluent either directly to the Kawartha Lakes or their watershed, or to waterbodies that flow into the Kawartha Lakes. The purpose of STPs is to protect public health by minimizing the discharge of pathogens and to protect the environment by minimizing the discharge of phosphorus (P) to our lakes. Of primary interest to KLSA is the quantity of phosphorus that is discharged by these plants to our lakes because phosphorus is known to be the most likely nutrient to cause increases in the growth of aquatic plants and algae.

Lake management studies have shown that the amount of phosphorus now discharged from STPs is only a small percentage of the phosphorus entering our lakes from all sources. This was not always the case. Prior to the 1970s, STPs discharged between 50 and 100 times more phosphorus than modern STPs. However, unlike most other phosphorus sources that are widely distributed, STPs are localized sources that can be controlled and considerable public dollars are spent to build and operate these plants to protect our health and the environment. Municipalities fund STPs by charging the users of the systems an annual levy but they also receive grants from the federal and provincial governments, i.e., all taxpayers, that partly offset the cost of capital projects to repair, upgrade and increase the capacity of STPs.

KLSA monitors the performance of STPs to determine if they are being operated to their fullest potential. Ideally KLSA would like all STPs that discharge directly to our lakes to achieve a 99% phosphorus removal rate. This means that only one part in 100 of the phosphorus entering the plant leaves in the effluent. A drop of removal rate to 95% means five parts in 100 leave the plant, which is five times more phosphorus released compared to 99% removal rate. What might seem like a small change in removal rate can have a very large consequence!

As we have indicated in past years, our STP data is always one year behind, because the reports for the most recent year are not available to us before going to press. This year, all of the reports were available online on the websites of their respective municipalities. Due to changes in the City of Kawartha Lakes website, key tables in their online reports were not included, but they were provided upon request.

Again this year, we have included three STPs, - Minden, Port Perry and King's Bay, which do not discharge directly into the Kawartha Lakes. These plants are upstream of our Kawartha Lakes and have at least one body of water in between to attenuate the effects of their effluent discharge.

Minden

Minden's STP discharges to the Gull River just above Gull Lake, which is two lakes away from our most upstream Kawartha lake, Shadow Lake. The average annual removal rate in 2020 was 98.2% without accounting for bypasses. One bypass of the sand (tertiary) filters occurred due to failure of a backwash pump between July 10 and July 13. An estimated 1,356 m^3 of partially treated sewage entered the river. Based on samples taken during these events it is estimated that the P load to the river was 0.15 kg. This increased the total annual P load to **11.1 kg**, much less than last year's 23.9 kg. The Minden STP's effective removal rate was **98.1%** compared to 95.3% last year. No other spills, bypasses or overflows were reported and no complaints related to the plant's operation were received during the year.

Average *E. coli* discharges were generally low during the year. The geometric mean of samples during the year ranged from 1.7 to 80 cfu/100 mL with an average value of 11.4 cfu/100mL, well within the plant's Certificate of Approval level of 200 cfu/100mL.

Coboconk

This lagoon system continued to function well in 2020, with planned discharges to the Gull River just above town occurring in May and November. The average phosphorus content of all effluent discharges was less than 0.04 mg/L. With lagoon systems such as Coboconk's, the volume of effluent released from the lagoons each year may be considerably more or less than the volume of raw input to the plant during the year. This may be due to operational considerations and variable amounts of precipitation and evaporation. Hence, determining the phosphorus removal rate is problematic. Considering all inputs and outputs over the past ten years, the overall phosphorus removal rate was **greater than 96.9%** during that period and the 2020 total annual discharge of phosphorus was estimated to be **2.8 kg**.

2020 Kawartha Lakes Sewage Treatment Plants Report

The geometric mean of *E. coli* in the discharges in spring and fall were 1.59 and 1.59 cfu/100mL respectively. No spills or bypasses occurred during 2020, however there were four complaints about odour received during the year.

Fenelon Falls

In 2020, the Fenelon Falls Waste Water Treatment Plant (WWTP) had difficulty coping with winter rain and snowmelt events. In January, the Colborne Street sewage pumping station overflowed, releasing 1,659 cubic metres of raw sewage into the Fenelon River. The new Ellice pumping station wet weather flow detention tank that had been built to contain such events was full before the event began. During the same rain event, the Ellis Street WWTP was also overwhelmed, and 6,220 cubic metres of partially treated wastewater bypassed the tertiary filters. These two events resulted in approximately 2.25 kg of phosphorus entering the lakes. Another bypass of the tertiary filters in March resulted in another 1.3 kg of phosphorus entering the lake. The annual average removal rate of the plant was 94.4%, down from last year's 95.7% and the overflow and bypasses reduced the overall removal efficiency to **93.9%**. This resulted in a P discharge to Sturgeon Lake of **39.6 kg** for the year.

Again this year *E. coli* levels in the effluent from the Fenelon Falls WWTP were generally low with an annual average geometric mean of 2.5 and a maximum of 7.3 cfu/100mL. No complaints about plant operations were received in 2020.

Lindsay

The Lindsay WWTP is the largest on the lakes. The City of Kawartha Lakes (CKL) owns the Lindsay plant and operated it until the end of July 2015 when its operation was contracted to the Ontario Clean Water Agency (OCWA) which operates all the other sewage treatment plants owned by CKL. Prior to 2015, the quantity of raw influent was not measured but reported to be equal to the measured quantity of effluent leaving the plant. This is a conservative estimate that does not include the volume of sludge removed during treatment which is typically 2% to 4% of the influent volume. The same procedure is used in the Fenelon Falls and Bobcaygeon plants. After 2015, influent volumes have been reported as being 15% to 18% higher than effluent flows which results in calculated phosphorus removal rates being 0.5% to 1% higher than they would be if using the former method. Upon enquiry, I was told that effluent flows at all plants are measured with electromagnetic flow meters which are accurate and reliable devices. At the Lindsay plant the influent flow is measured with a Parshall flume which has its limitations especially when flows are high. This year, KLSA has used the sum of effluent and sludge volume to estimate the influent volume at the Lindsay plant and this resulted in a lower calculated phosphorus removal rate.

In 2020, the Lindsay WWTP operated well with no reported spills, bypasses or abnormal discharges from the plant. One small spill of about 2.2 m^3 of wastewater occurred in July at a city park but it was cleaned up without any escaping the area. It is estimated that the 2020 annual average phosphorus removal rate was **97.7%**, similar to last year's 97.3%. This resulted in a P discharge to Sturgeon Lake of **307.4 kg**, down from 364.7 kg last year.

The annual average geometric mean of *E. coli* in the discharge was 4 cfu/100mL with a maximum of 7.5 cfu/100mL in May. No complaints about the operation of the STP were reported in 2020.

Bobcaygeon

The significant improvement in the performance of the Bobcaygeon WWTP in 2019 continued in 2020. It appears that the 2019 repairs to sanitary sewers to reduce infiltration have substantially reduced inflows during wet weather, easing the load on the plant.

In 2020 the average phosphorus removal rate for the Bobcaygeon WWTP was calculated to be at least **97.8%**, up from last year's 96.7%. The reported annual phosphorus load to the lake was **37.9 kg**, only 60% of last year's 65.5 kg. There is some uncertainty in the calculations of phosphorus removal rate as was illustrated at Bobcaygeon in 2020. While the effluent is sampled and tested for phosphorus content several times each month, the raw influent is typically sampled and tested only once per month. There is considerable variation in the raw influent test results. While annual averages typically range between 2 and 3.5 mg/L, individual monthly results have varied over the years between 0.03 and 12.5 mg/L. In July 2020, the reading was 0.03 mg/L, considerably less than July's average effluent phosphorus content of 0.044 mg/L. This resulted in the reporting of a negative removal efficiency for the month of July, indicating

that more phosphorus left the plant in the effluent than came into the plant in the raw sewage, a highly unlikely situation. If the July influent phosphorus content was higher than reported, the annual removal efficiency would be raised so the value calculated above is conservative.

A disturbing incident took place at the Bobcaygeon WWTP in December. At about 6 p.m. on Friday, December 4th, after staff had left the plant, a power outage occurred throughout the Bobcaygeon area. The plant's emergency generators came on and continued to run the plant. However, during the power transfer, two aeration blowers faulted and failed to operate. Alarms about the blower malfunctions were immediately sent to Trent Security, "but the on-call operator was not paged". The situation was not discovered until a plant operator came on shift Monday morning, December 8th, and was able to restart the blowers. During the 61 hours of the event, the plant continued to process 6,164 m^3 of sewage. Effluent samples were taken at the end of the event which showed that carbonaceous biochemical oxygen demand (CBOD) was 50 to 100 times higher than normal, but this was quickly resolved when the blowers were reactivated. The report stated that effluent phosphorus content was also measured, but the results were not provided in the report, so it is not possible to determine whether there was an increase in phosphorus release during this event. Had more crucial pieces of equipment failed to operate and be discovered, the outcome of this event might have been much more serious.

The above event was reported as a bypass although all processes except aeration had been performed. One small spill was reported as a result of water seeping from a manhole due to a valve problem. It was estimated that less than 1 m^3 was released.

The annual average *E. coli* in the discharge was 2.8 cfu/100mL with a maximum of 8.5 cfu/100mL in October. A number of minor complaints about odour, lighting and paint work were received during the year and maintenance was performed.

Omemee

This facility consists of two large settling lagoons. Until 2014 all of the effluent was spray-irrigated onto nearby fields during the summer months. A subsurface effluent disposal system was commissioned at the site in March, 2014 with the intention that it would dispose of all the effluent. However, problems with the capacity of this system have required that both the spray irrigation and subsurface disposal systems be used. In 2020, about 56% of the effluent was sprayed between May and the end of November. Approximately 44% of the 2020 effluent was disposed of by the subsurface disposal system during the colder months. In June 2020, the City of Kawartha Lakes gave notice of a Class Environmental Assessment study of the Omemee large subsurface disposal system (LSSDS) to evaluate long term solutions to its capacity issues. Consulting firm Greer Galloway has been contracted to carry out the study. A Public Information Meeting was held on July 15, 2021 presenting proposed improvements which included treatment of the effluent to reduce suspended solids and algae, enlarged wet well, improved distribution system to allow reduced hydraulic loading of the LSSDS and the concurrent use of both the LSSDS and the spray irrigation system. It is expected that the final proposed solution will be presented at a public meeting in early in 2022.

The average effluent phosphorus concentration in 2020 was 0.21mg/L, similar to last year's 0.21 mg/L and well below the allowable 1.0 mg/L. Lagoon systems can have considerable volume buffering capacity with the volume of raw influent and treated effluent varying considerably from year to year. In 2020 the effluent discharged was about 127% of the influent volume. Based on the numbers provided, phosphorus removal was estimated to be **~84%** with ~53.8 kg being distributed to the irrigation fields and subsurface system. However, because the effluent is applied to land far from Pigeon Lake, removal is probably almost **100%** with respect to our lakes.

The annual average *E. coli* level in the effluent was 190 cfu/100mL this year. This lagoon facility did not require any emergency discharges to the Pigeon River in 2019 and there were no spills or bypasses reported. No significant complaints were received about the operation of the STP or collection system.

King's Bay

The King's Bay STP serves a golf course community situated on a peninsula between Lake Scugog and the Nonquon River. Houses down the centre of the peninsula are surrounded by the golf course. Treated effluent from the STP at the apex of the

peninsula is discharged into two large disposal beds under the golf course on each side of the peninsula. One up-gradient and three down-gradient wells are located around each disposal bed to monitor groundwater for phosphorus migration.

The King's Bay STP treats sewage using two Rotating Biological Contactor (RBC) units. Both RBCs were used to treat waste during 2020 and the system performed well except that Total Suspended Solids (TSS) in the effluent continue to be higher than desired. Effluent TP concentration of discharge to the underground disposal beds averaged 0.37 mg/L, slightly lower than the 0.41 mg/L in 2019, out of an allowable 1.0 mg/L. The annual daily loading for 2020 was 0.016 kg per day, about 10% of the allowable discharge of 0.17 kg per day. The annual average phosphorus removal rate within the plant was 99.0% this year. No bypasses, spills or abnormal discharges occurred in 2020 and there were no complaints about the plant.

Monitoring wells located both up and down gradient from the disposal sites have had sporadic high TP readings in past years. In 2016 the TP measurement procedure was changed to collecting a field filtered grab sample from each well twice a year. TP levels in the two upgradient wells and the west downgradient wells have all remained low over the past four years. However, two of the east downgradient wells, #1 and #3, have had variably high readings for a few years, but with no consistent pattern to the high readings. The purpose of the monitoring wells is to detect phosphorus migration towards the lake or the Nonquon River. Since these wells average 100 m from the lake or the Nonquon River, it is probable that, at least for the time being, there is still effectively **100%** removal with respect to the lake.

Port Perry

Port Perry is served by the Nonquon Waste Pollution Control Plant (WPCP) which discharges treated effluent into the Nonquon River northwest of Port Perry, which, in turn, empties into Lake Scugog at Seagrave, where the King's Bay facility is located. A new modern plant designed to treat wastewater at an average daily flow rate of 5,900 m^3/d was commissioned in 2017. The new system performed well in 2020. Previous difficulties with the scum removal system were not mentioned in the 2020 report and it is assumed they have been solved.

In 2020, phosphorus was reduced to an annual average of 0.08 mg/L for a total loading of **86.3 kg**, up considerably from last year's 52.0 kg. This reflects a removal rate of **97.9%**, down from last year's 98.7%. *E. coli* levels this year were between 1 and 4 cfu/100mL. There were no reported bypasses, spills or abnormal discharges and no complaints were received during 2020.

Summary

The total weight of phosphorus discharged to the mainstream Kawartha Lakes from the Lindsay, Fenelon Falls and Bobcaygeon WWTPs in 2020 was 385 kg, considerably lower than last year's 464 kg. If we include all the plants that we now monitor, we had total phosphorus loading to the lakes of 485 kg in 2020 compared to 545 kg in 2019. If all plants had achieved the 99% removal rate that we would like, the total phosphorus discharge for the year would have been about 203 kg or about 42% of the 2020 total.

KLSA Annual Review of Area Sewage Treatment Plant Performance

Plant Location - Discharges to & Type	Year	Phosphorus Removal Rate % (1)	Total Annual TP Load Out kg (2)	Annual TP Load if 99% kg (3)	E. coli (cfu/100mL)	Bypasses, Spills, Comments
Minden - Gull River Extended aeration activated sludge process with tertiary treatment	2013	90.1%	53.9	5.4	7.2	Bypass resulted in ~40 kg extra P load
	2014	96.7%	19.4	5.8	9.0	None reported
	2015	96.4%	17.9	4.9	68.0	None reported
	2016	89.7%	44.9	4.4	81.0	Bypass resulted in ~22 kg extra P load
	2017	92.3%	32.9	5.4	297.0	Bypass resulted in ~8.7 kg extra P load
	2018	96.2%	16.6	4.4	82	Bypass resulted in ~0.4 kg extra P load
	2019	95.3%	23.8	5.1	268	Bypass resulted in ~4.2 kg extra P load
	2020	98.1%	11.1	6.0	11.4	Bypass resulted in ~0.2 kg extra P load
Coboconk - Gull River Mill Pond Dual lagoons semiannual discharge to river	2013	97.4%	3.2	1.0	12.4	None reported
	2014	>97.8%	< 3.1	1.7	3.7	None reported
	2015	>98.0%	< 2.2	1.1	2.5	None reported
	2016	>97.6%	4.2	1.2	3.4	None reported
	2017	>97.3%	5.1	1.1	2.7	None reported
	2018	>97.0%	4.0	1.2	1.6	Overflow of 50m³ - no P load to Gull R
	2019	>96.9%	5.0	1.1	12.2	None reported
	2020	>96.9%	2.8	1.0	1.6	None reported
Fenelon Falls - Sturgeon Lake Extended aeration activated sludge process with tertiary treatment	2013	95.2%	45.6	9.1	2.0	Bypass resulted in ~ 19.1 kg extra P load
	2014	94.5%	51.8	9.1	2.0	Bypass resulted in ~ 21 kg extra P load
	2015	96.3%	26.3	7.2	2.0	None reported
	2016	94.6%	38.8	7.2	3.3	Bypass resulted in ~ 10.4 kg extra P load
	2017	94.6%	49.1	9.1	2.3	Bypass resulted in ~ 1.6 kg extra P load
	2018	95.8%	34.0	8.0	2.2	Bypass resulted in ~ 1.5 kg extra P load
	2019	95.7%	33.7	7.7	9.0	None reported
	2020	93.9%	39.6	6.4	2.5	Bypass resulted in ~ 3.5 kg extra P load
Lindsay - Sturgeon Lake Flow equalization lagoons; extended aeration activated sludge process with Actiflo tertiary treatment	2013	98.0%	220	112.2	4.0	None reported
	2014	96.0%	622	149.7	2.6	Bypass resulted in ~ 402 kg extra P load
	2015	>98.2%	<239.4	131.7	2.5	None reported
	2016	>98.6%	<176.8	134.3	3.5	None reported
	2017	97.5%	311.7	125.9	11.0	Overflow resulted in ~0.5 kg extra P load
	2018	97.4%	301.1	115.4	14.0	Overflow resulted in ~0.1 kg extra P load
	2019	97.2%	364.7	132.8	11.2	None reported
	2020	97.7%	307.4	131.2	4.0	None reported
Bobcaygeon - Pigeon Lake Extended aeration activated sludge process with tertiary treatment	2013	96.9%	85.4	27.5	3.4	None reported
	2014	97.9%	61.7	29.4	7.4	None reported
	2015	98.0%	51.8	26.9	21.0	None reported
	2016	95.8%	125.6	30.0	31.0	Spill of 1 Litre reported
	2017	94.7%	114.7	19.7	53.7	None reported
	2018	93.0%	171.3	24.4	98.8	None reported
	2019	96.7%	65.5	19.8	4.9	None reported
	2020	97.8%	37.9	16.9	2.8	Spill of 1 m³ reported
Omemee - Fields/Underground Dual lagoons with spray irrigation; pumped into underground disposal beds beginning 2015	2013	100.0%	0	0.0	-	None reported
	2014	100.0%	0	0.0	-	None reported
	2015	100.0%	0	0.0	143.0	None reported
	2016	100.0%	0	0.0	496.0	None reported
	2017	100.0%	0	0.0	150	None reported
	2018	100.0%	0	0.0	172	None reported
	2019	100.0%	0	0.0	132	None reported
	2020	100.0%	0	0.0	190	None reported
King's Bay - Underground Pumped into underground disposal beds.	2013	100.0%	0	0.0	-	None reported
	2014	100.0%	0	0.0	-	None reported
	2015	100.0%	0	1.1	-	Spill resulted in ~1.14 kg release to lake
	2016	100.0%	0	0.0	-	None reported
	2017	100.0%	0	0.0	-	None reported
	2018	100.0%	0	0.0	-	None reported
	2019	100.0%	0	0.0	-	None reported
	2020	100.0%	0	0.0		None reported

Port Perry - Lake Scugog Extended aeration activated sludge process with tertiary treatment; effluent discharge to Nonquon River.	2013	97.0%	121.3	40.4	-	None reported
	2014	96.6%	144.2	42.4	-	None reported
	2015	98.2%	69.7	37.8	-	None reported
	2016	97.8%	75.3	33.6		None reported
	2017	98.8%	52.3	45.3	2	None reported
	2018	99.0%	44.5	44.4	2	None reported
	2019	98.7%	52.0	40.9	1	None reported
	2020	97.9%	86.3	41.0	2	None reported

(1) 'Phosphorus Removal Rate %' is the percentage of the phosphorus in the plant influent that is removed before effluent is discharged.
(2) 'Total Annual TP Load Out kg' is the total weight of phosphorus, in kilograms, that is discharged from the plant during the year.
(3) 'Annual TP Load if 99% kg' is the total weight of phosphorus, in kilograms, that would be discharged from the plant during the year if the plant achieved a 99 % Phosphorus Removal Rate.

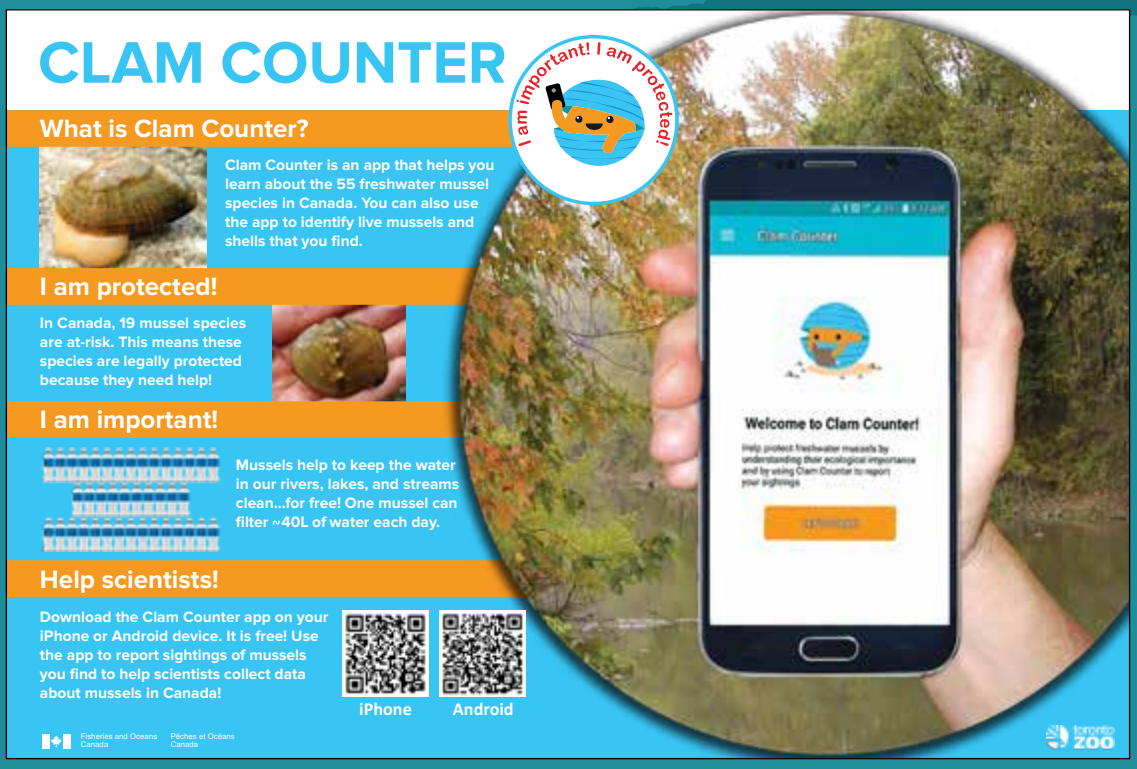
VOLUNTEER TO BE A COMMUNITY SCIENTIST CLAM COUNTER

C. Lee, *KLSA Director*

The freshwater mussels (or clams) in our lakes and streams are an important part of a healthy ecosystem. These invertebrates are often overlooked but they play an important role as filter feeders eating bacteria, algae and zooplankton. In turn, they are food for fishes, aquatic birds and mammals. Mussels can be very long lived with some Ontario species reaching 100 years. However, they are sensitive to changes in water quality and invasive species like zebra mussels.

Biologists are asking citizens to use the new bilingual "*Clam Counter*" app to assist their research efforts to identify populations in our lakes. Looking along the shorelines or in shallow waters they can be easily seen. You can help to conserve the health of our Kawartha Lakes and participate in a fun activity this summer by using *Clam Counter*. Why not help out?

See the poster below and follow the instructions to become a Clam Counter.



Appendix A - KLSA Mission Statement, Board of Directors and Scientific Advisors

KLSA Mission Statement

The Kawartha Lake Stewards Association (KLSA) was founded to carry out a coordinated, consistent water quality testing program (including bacteria and phosphorus) in lake water in the Kawartha Lakes. KLSA ensures that water quality test results, prepared according to professionally validated protocols with summary analysis, are made available to interested parties. The Kawartha Lake Stewards Association has expanded into research activities that help to better understand lake water quality and may expand its program into other related issues in the future.

2021 – 2022 Board of Directors

Ed Leerdam
Chair/Treasurer
Nogies Creek

Tom McAllister
Vice-Chair
Lower Buckhorn Lake

Carol Cole
Secretary
Stony Lake

Sheila Gordon-Dillane
Recording Secretary
Pigeon Lake

Robert Bailey
Director
Lower Buckhorn Lake

Anna Currier[1]
Director
Catchacoma Lake

Jeffrey Chalmers
Director
Clear Lake

Mike Dolbey
Director
Katchewanooka Lake

C. Lee
Director
Balsam Lake

Tracy Logan[2]
Director
Big Bald Lake

Jacqui Milne[3]
Director
Nogies Creek

William A. Napier[4]
Director
Lovesick Lake

Kimberly Ong[5]
Director
Stony Lake

Brett Tregunno
Director
Omemee

[1] *until July 15, 2021*
[2] *until January 15, 2021*
[3] *effective October 18, 2021*
[4] *until April 9, 2021*
[5] *effective March 12, 2021*

Scientific Advisors

Dr. Paul Frost, David Schindler Professor of Aquatic Science, Trent University, Peterborough
Sara Kelly, Faculty, Ecosystem Management Program, Fleming College, Lindsay
Dr. Eric Sager, Ecological Restoration Program, Fleming College and Trent University, Peterborough
Dr. Andrea Kirkwood, Associate Professor, Faculty of Science, Ontario Tech University, Oshawa

Appendix B - Donors

Thank You to our 2021 Supporters

FOUNDATIONS AND MUNICIPALITIES

Gold ($5,000+)

Silver ($1,000 - $4,999)
Douro-Dummer
Municipality of Trent Lakes

Bronze (less than $1,000)
Township of Selwyn

ASSOCIATIONS/BUSINESSES/INDIVIDUALS

Gold ($200+)

Ann and John Ambler
Balsam Lake Association
Crystal Lake Cottagers Association
Susan and Mike Dolbey
Janet and Paul Duval
Sheila Gordon-Dillane and Jim Dillane
Janet Haslett-Theall and Larry Theall
Carol and Ralph Ingleton
Mary and Jim Keyser
Penny and Rob Little
Patti and Tom McAllister
Paris Marine
Pinewood Cottages and Trailer Park
Judy and Lou Probst
Rosedale Marina

Silver ($100 - $199)

Nancy Austin and Chris Appleton
Birch Cliff Property Owners Association
Peter Chappell
Fire Route 44 Cottagers Association
Gill Fisher and Bob Woosnam
Elaine Gold
Mary and Ted Hill
Lakefield Foodland
Ted Oakes
Peterborough Pollinators
Rosemary and Claudio Rosada
Janice and Ian Smith
Cathy and Jeff Webb
Jean and Joe Wood

Bronze (less than $100)

Big Cedar Lake Stewardship Association
Buckhorn Sands Property Owner's Association
Yvonne Flavelle
Anne Hurd
Ed Leerdam
Carol and David MacLellan
Violet and Daniel McMurdy
Sandy Lake Cottagers Association
Serendipity Bed and Breakfast

Appendix C - Treasurer's Report

KLSA Treasurer's Report as of December 31, 2021

Ed Leerdam, *KLSA Treasurer*

This Treasurer's Report refers to the 2021 calendar year and the H & R Block Statement of Financial Position summarizing Revenue, Expenditures and Assets for 2020 and 2021 Fiscal Years. Our thanks to Mr. Chad Irvine of H & R Block for preparing these Financial Statements.

2021 Revenue of $25,172 increased by 31% over 2020's revenue. Year-over-year increases in donations from Lake & Cottage Associations (65.5%) and Businesses (33.3%), and increased number of water *E. coli* tests (i.e., more places tested! – increase of over 15%!), account for some of this increase. The biggest contributor came from a grant to naturalize a number of shorelines and the owners' portions of the costs. While this program is not intended to generate revenue, we did not spend as much as estimated in 2021, so with the remaining funds, and possible further grants, we have plans to continue this program in 2022.

Our continuing sources of income were:

• Water Testing Fees	$4,514
• Municipal Grants	$2,275
• Private Business / Individual Donations	$4,920
• Association Donations	$1,100
• Advertising in the KLSA annual LWQR	$5,600

2021 Expenses of $15,158 increased by just under 8% over 2020 expenses. We enhanced our Liability Insurance to cover risks associated with potential exposure to Cyber threats. The increase in water testing fees is associated with the increase in numbers of tests and test fees paid to SGS Labs. The purchase of native or indigenous plants and shrubs expense is related to the shoreline naturalization program grant and owners' fees and contributed to the overall increase in expenses in 2021.

Recurring operating expenses included:

• E. coli Lab Test Fees	$4,440
• KLSA Insurance	$1,597
• KLSA Annual Water Quality Report	$4,754
• Semi-Annual Public Meetings	$ 0
• Office and Banking	$ 0
• Memberships	$ 125
• Professional Fees	$ 339
• Bank Charges	$ 73

We closed 2021 with a cash position of $24,845.

Kawartha Lake Stewards Association
Statement of Financial Position

As At December 31, 2021

	2021	2020
Assets		
Cash	24845	14831
Prepaid Expenses	132	132
	24977	14963
Liabilities		
Accounts Payable and Accrued	339	339
Net Assets	24638	14624
	24977	14963

Prepared Without Audit- See Notice to Reader

Kawartha Lake Stewards Association
Statement of Operations and Changes in Net Assets

Year Ended December 31, 2021

	2021	2020
Revenues		
Private Contributions and Donations	4920	4873
Associations	1100	665
Municipal Grants	2275	2500
Private Grants	4000	913
User Fees	2750	
Advertising	5600	6350
Water Testing Fees	4514	3920
Interest Earned	13	
	25172	19221
Expenditures		
Annual Report Costs	4754	4504
Water Testing Fees	4440	3718
Meeting Costs		23
Professional Fees	339	339
Memberships	125	250
Insurance	1597	1110
Special Projects	3830	486
Office and Administration		241
Bank Charges	73	68
Equipment		3301
	15158	14040
Excess of Revenues over Expenditures	10014	5181
Net Assets, Beginning of Year	14624	9443
Net Assets, End of Year	24638	14624

Prepared Without Audit- See Notice to Reader

Appendix C - Financial Statements

Kawartha Lake Stewards Association

Notes to Financial Statements

Unaudited- See Notice to Reader

December 31, 2021

1. Basis of Presentation

The accompanying financial statements relate to the Incorporated Association registered by Letters Patent as the Kawartha Lake Stewards Association. The Association conducts coordinated consistent water quality testing programs (including bacteria and phosphorus) of lake water on lakes within the Trent Canal System watershed. The association derives it's revenue from those groups and individuals who are concerned about maintaining the quality of water within the watershed.

Kawartha Lake Stewards Association qualifies as a non-profit organization under section 149(1) of the Income Tax Act, and, as such, is not responsible to pay income tax. The distribution of any of its assets or profits to, or for the personal benefit, of its members or affiliates is prohibited.

Appendix C - Financial Statements

Notice to Reader

I have compiled the Statement of Financial Position of Kawartha Lake Stewards Association as at December 31, 2021 and the Statement of Operations and Changes in Net Assets for the year then ended from information provided by the organization

I have not audited or reviewed such information. Accordingly, readers are cautioned that these Statements may not be appropriate for their uses

Chad R. Irvine

Bobcaygeon, ON

Jan 14, 2022

Appendix D - Thank You to our 2021 Volunteers

Thank You to our 2021 Volunteers

Without our volunteers, whether serving on our Board, leading a program, scooping water or aquatic plants out of our lakes, planting natural plants along shorelines, or attaching a temperature monitor on their docks, KLSA would not exist, and not be able to do the work and collect the data that is so important in knowing how good (or not) our waters are in our lakes, and what's in them. We are very grateful to all our volunteers who help us in all these ways, and more.

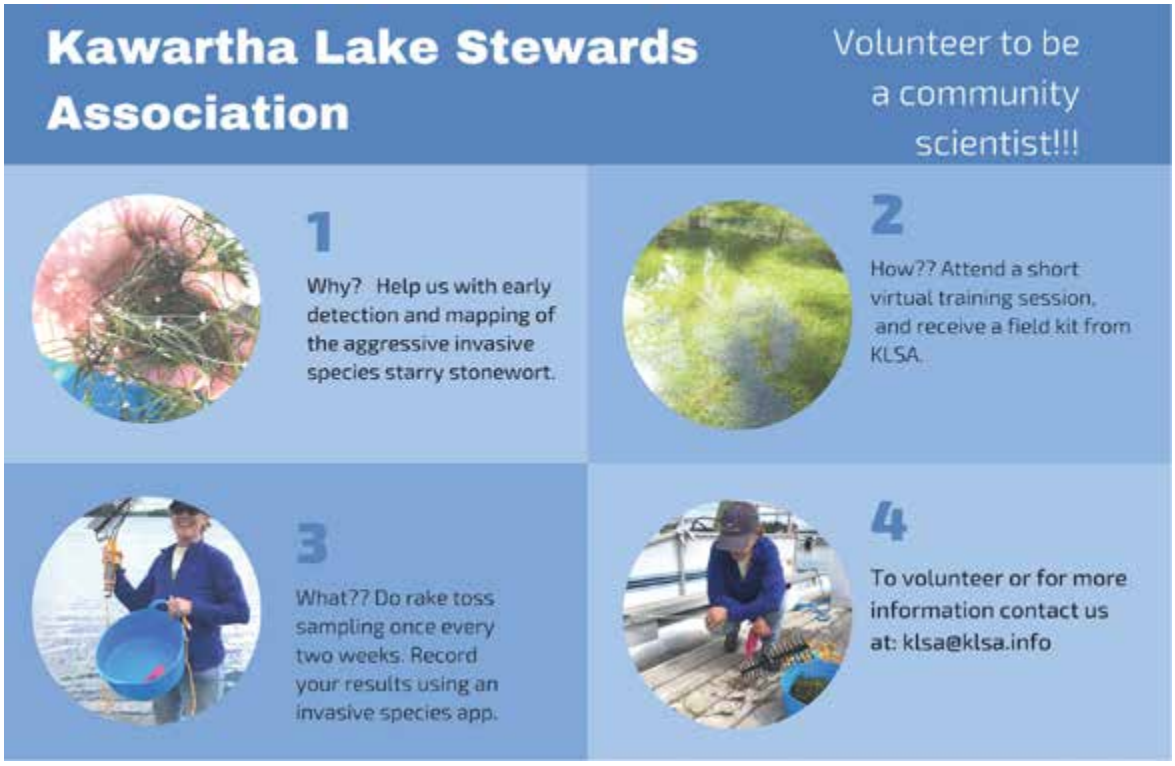
(We strive to ensure no-one is missed when we acknowledge our volunteers. If you see we have missed you or we've made a mistake please let us know at klsa@klsa.info.)

Mary Ellen Abberger
Bob Bailey[1], Lower Buckhorn Lake
Kingdon Baker, Chandos Lake
Drew Beatson, Chemong Lake
Sandy Beatson, Chemong Lake
Bigg family, Buckhorn Lake (Buckhorn Sands Property Owners' Association)
Dian Bogie, Lovesick Lake (Lovesick Lake Cottagers' Association)
Rick Bogie, Lovesick Lake (Lovesick Lake Cottagers' Association)
John Boyce, Big Bald Lake (Big Bald Cottagers' Association)
Nancy Boyce, Big Bald Lake (Big Bald Cottagers' Association)
Diane Boysen, Sandy Lake (Sandy Lake Cottagers Association)
Mike Boysen, Sandy Lake (Sandy Lake Cottagers Association)
Phil Brace, Canal Lake
Brian Brady, Lower Buckhorn Lake (Lower Buckhorn Lake Owners' Association)
Heather Brooks
Steve Brooks
George Brown, Pigeon Lake (North Pigeon Lake Association)
Jeff Chalmers[1], Clear Lake (Birchcliff Property Owners of Douro-Dummer)
Graham Clark, Balsam Lake
Carol Cole[1,2], Ston(e)y Lake
Doug Colmer, Big Cedar Lake
Joan Connolly, Lovesick Lake
Rich Corbin, Big Bald Lake (Big Bald Cottagers' Association)
Mark Crane, Cameron Lake (East Cameron Lake Association)
Nancy Cumming, Balsam Lake
Anna Currier[1], Catchacoma Lake
Darrell Darling, Young's Cove
Jennifer Darling, Ston(e)y Lake
Doug Dewar, Big Bald Lake
Mike Dolbey[1], Katchewanooka Lake
Warren Dunlop, Pigeon Lake (North Pigeon Lake Association)
Janet Duval, Lower Buckhorn Lake (Lower Buckhorn Lake Owners' Association)
Paul Duval, Lower Buckhorn Lake (Lower Buckhorn Lake Owners' Association)
Emma Ekin, Buckhorn Lake
Gregorius Erico
Doug Erlandson, Balsam Lake
Peggy Erlandson, Balsam Lake
Greg Finlay, Ston(e)y Lake
Steve Foulon, Clear Lake
Bev Foster, Ston(e)y Lake (Ston(e)y Lake Cottagers)
Don Foster, Ston(e)y Lake (Ston(e)y Lake Cottagers)
Jessie Gordon, Pigeon Lake (Concession 17 Pigeon Lake Cottagers Association)
Sheila Gordon-Dillane[1], Pigeon Lake (Concession 17 Pigeon Lake Cottagers Association)
Ann Gronow, Clear Lake
Bruce Hadfield, Sturgeon Lake
Don Halloway, Sturgeon Lake
Guy Hanchet, Katchewanooka Lake
Doug Hawe, Balsam Lake
Dan Hickey, Pigeon Lake
Jess Horn
Mitchell Horn
Sheelagh Hysenaj, Jack Lake
Imagine the Marsh
Sherrie Ireland, Sandy Lake
Shane Keenan, Sandy Lake
Peter Kelly, Balsam Lake
Sarah Kennedy
Eunji Kim
Janet Klein, Nogies Creek (North Pigeon Lake Association)
Chloe LaJoie, Watersheds Canada
Jim LaPointe, Pigeon Lake (Concession 17 Pigeon Lake Cottagers Association)
C. Lee[1,2], Balsam Lake
Ed Leerdam[1], Nogies Creek (North Pigeon Lake Association)
Tracy Logan[1], Big Bald Lake
Bruce Long, Cameron Lake
Ruth Long, Cameron Lake
Karl Macarthur, Upper Stoney Lake (Upper Stoney Lake Association)
Patty MacDonald, Ston(e)y Lake
Kathleen Mackenzie, Ston(e)y Lake (Ston(e)y Lake Cottagers)
MacLellan family, Julian Lake
Dean Mairs, Balsam Lake
Rod Martin, Sturgeon Lake
Tom McAllister[1], Lower Buckhorn Lake (Fire Route 44 Cottagers Association)
Dean Michel, Balsam Lake
Jacqui Milne[1], Nogies Creek (North Pigeon Lake Association)
Roz Moore, Ston(e)y Lake
William Napier[1], Lovesick Lake

Appendix D - Thank You to our 2021 Volunteers

Brian Neck, Chemong Lake
Linda Neck, Chemong Lake
Michelle Newton, Ston(e)y Lake
Kimberly Ong[1,2], Ston(e)y Lake
Brenda Ounjian, Pigeon Lake (Victoria Place)
Doug Paterson, Balsam Lake
Paul Pause, Lower Buckhorn Lake (Lower Buckhorn Lake Owners' Association)
Line Pinard, Pigeon Lake (North Pigeon Lake Association)
Diane Potter, Lower Buckhorn Lake (Lower Buckhorn Lake Owners' Association)
Mark Potter, Lower Buckhorn Lake (Lower Buckhorn Lake Owners' Association)
Denise Pratt, Balsam Lake
Rob Purdy, Upper Buckhorn Lake
Dylan Radcliffe
Ralph Reed, Ston(e)y Lake (Ston(e)y Lake Cottagers)
Doug Ridge, Sturgeon Lake
Melissa Rose, Upper Buckhorn Lake
Ben Samann, Ston(e)y Lake
Jan Sanderson, Balsam Lake
Peter Sanderson, Balsam Lake
Sonny Seymour, Sturgeon Lake
Aaron Shafer, Ston(e)y Lake
Harry Shuman, Lower Buckhorn Lake (Lower Buckhorn Lake Owners' Association)
Kathy Simpson Price, Bass Lake
Robert Sproat, Balsam Lake
Steeter family, Sandy Lake (Sandy Lake Cottagers Association)
Patrick Strzalkowski, Clear Lake (Kawartha Park Cottagers' Association)
Carolyn Sutton, Ston(e)y Lake
David Sutton, Ston(e)y Lake
Gail Szego, Ston(e)y Lake (Ston(e)y Lake Cottagers)
Annette Thomson, Chemong Lake
Dave Thomson, Lower Buckhorn Lake (Lower Buckhorn Lake Owners' Association)
Steve Thomson, Chemong Lake
Eva Toomsalu, Sandy Lake (Sandy Lake Cottagers Association)
Hans Toomsalu, Sandy Lake (Sandy Lake Cottagers Association)
Diane Trauzzi, Big Cedar Lake (Big Cedar Lake Stewardship Association)
Ralph Trauzzi, Big Cedar Lake (Big Cedar Lake Stewardship Association)
Brett Tregunno[1,2], Buckhorn Lake
Robert Tuckett, Balsam Lake
Brenda Wall, Bass Lake (North Pigeon Lake Association)
Lois Wallace, Upper Stoney Lake
Tina Warren, Upper Stoney Lake
Cathy Webb, Lovesick Lake
Jeff Webb, Lovesick Lake
Steven Wildfong, Katchewanooka Lake
Bob Woosnam, Ston(e)y Lake (Ston(e)y Lake Cottagers)
Gill Woosnam, Ston(e)y Lake (Ston(e)y Lake Cottagers)
Jennifer Wortzman, Ston(e)y Lake
Dave Young, Sturgeon Lake

[1] KLSA Board
[2] KLSA Program Leads



Appendix E - 2021 *E. coli* Test Results

Rationale for *E. coli* Testing and 2021 Lake-by-Lake Results

Mike Dolbey, *KLSA Director*

Providing context for these results

• In Ontario, a public beach is "posted" when the level of *E. coli* in the water exceeds 200 *E. coli* /100 mL which they claim is equivalent to *E. coli* cfu/100 mL (colony-forming units/100 mL) of water. This means that the water is unsafe for recreational use, including human bathing (swimming). (In 2018 the Province of Ontario increased the "posting" level for public beaches from 100 to 200 *E. coli* /100 mL based on the geometric mean of a minimum of 5 samples with a single-sample maximum concentration ≤ 400 *E. coli* /100 mL. This brought Ontario's limit into agreement with the Canadian Federal guideline).

• KLSA considers counts over 50 cfu/100 mL as somewhat high for the Kawartha Lakes, and cause for retesting where possible.

• Counts of 20 and below, with an occasional reading between 20 and 50, are normal for the Kawartha Lakes.

Choosing sites for the KLSA *E. coli* testing program

The goals of this testing are threefold:

• To see how safe the water is for swimming at these sites

• To provide baseline data for ongoing monitoring in future years

• To discover sources of elevated bacterial counts

Almost all sites were chosen because it was thought that they would have the highest *E. coli* counts in the lake; that is, we were 'looking for trouble'. Therefore, please realize that the readings shown here do not represent the average bacterial levels on our lakes; rather, they would represent some of the highest bacterial levels on our lakes. Test sites included:

• Areas of high use (resorts, live-aboard docking areas, etc.)

• Areas of low circulation (quiet, protected bays)

• Areas near inflows (from culverts, streams, wetlands)

• Areas of concentrated populations of wildlife (near wetlands, areas popular with waterfowl)

Please note:

• KLSA does not test drinking water. Only surface waters are tested. All untreated surface waters are considered unsafe for drinking.

• KLSA results are valid only for the times and locations tested and are no guarantee that a lake will be safe to swim in at all times and in all locations.

• Only sites consistent with provincial sampling protocol have been reported.

How and why do we test for *E. coli*?

The protocol for *E. coli* testing is found in the Ontario Ministry of Health and Long-Term Care's Operational Approaches to Recreational Water Guideline, 2018.

• The presence of *E. coli* usually indicates fecal contamination from warm-blooded animals such as birds or mammals, including humans. The presence of *E. coli* indicates the possible presence of other disease-causing organisms found in fecal material, such as those causing gastrointestinal and outer ear infections.

• *E. coli* is present in fecal material in very high numbers. Healthy humans excrete about 100 million *E. coli* per ¼ teaspoon of fecal matter! Therefore, it is easier to 'find' than most other less plentiful bacteria.

• *E. coli* itself can be dangerous. Although most strains of *E. coli* are harmless, some strains cause serious disease or illness, as occurs in occasional ground beef 'scares' which can lead to food poisoning. The basic analysis done by the laboratories cannot distinguish the difference between the harmless and the deadly, so we always treat all *E. coli* as if we were dealing with a harmful strain.

Results are expressed as *E. coli* cfu/100 mL. When sample water is plated on growth medium in the laboratory, each live bacterium will grow to form a visible colony. 'Cfu' signifies 'colony forming units'. 'Cfu' generally represents numbers of live bacteria as opposed to a microscopic count which would count both live and dead bacteria.

Appendix E - 2021 *E. coli* Test Results

What do this year's results tell us?

E. coli readings were, as in other years, predominantly less than 20 cfu/100 mL, with a few readings between 20 and 100. There was one reading over the former 'safe swimming limit' of 100 cfu/100 mL, but counts were low upon further testing.

Balsam Lake – Balsam Lake Cottager's Association						
2021 *E. coli* Lake Water Testing – *E. coli* cfu/100 mL						
Site	July 5	July 19	July 26	August 3	August 17	September 7
00	13	10	5	3	1	4
01	6	1	3	2	0	5
02	3	16	14	9	1	1
03	0	1	0	0	2	0
03A	20	2	1	4	46	4, 1
03B	5	32	6	3	3	0
04	0	6	0			
04A				2	1	6
05A	2	0	1	0	0	0
06A	1	3	0	5	0	1
07	2	4	1	0	0	0
20	29	7	2	4	4	1

We welcome back Balsam Lake testers. Results were generally low with a few scattered intermediate readings.

Bass Lake – Bass Lake Homeowners Association						
2021 *E. coli* Lake Water Testing – *E. coli* cfu/100 mL						
Site	July 5	July 19	July 26	August 3	August 17	September 7
A1	9	3	3	8	0	0

Counts were consistently low at this location on Bass Lake.

Big Bald Lake – Big Bald Lake Cottager's Association						
2021 *E. coli* Lake Water Testing – *E. coli* cfu/100 mL						
Site	July 5	July 19	July 26	August 3	August 17	September 8
1	42	25	18	12	4	7
3	9	10	7	3	5	14
9	16	11	5	0	2	1
10	10	9	18	15	0	3
12	2	4	3	1	0	1

Counts were generally higher in the earlier part of the year, perhaps due waterfowl activity.

Appendix E - 2021 *E. coli* Test Results

Big Cedar Lake – Big Cedar Lake Stewardship Association						
2021 *E. coli* Lake Water Testing – *E. coli* cfu/100 mL						
Site	July 5	July 19	July 27	August 3	August 17	September 7
600	4	4	7	4	7	2
610	4	4	0	0	0	0
620	0	3	9	1	1	1
630	3	2	0	2	1	0
640	1	0	2	8	0	0
650	7	1	2	4	10	4

Counts were consistently low at all 6 sites on Big Cedar Lake.

Buckhorn Lake – Buckhorn Sands Property Owners Association							
2021 *E. coli* Lake Water Testing – *E. coli* cfu/100 mL							
Site	June 30	July 5	July 19	July 27	Aug 4	Aug 18	Sept 7
A	18	31	0	0	0	2	4
B	37	41	8	32	13	1	2
C	14	3	5	2	7	1	3
D	**67**	**60**	7	18	1	1	1

Counts were generally higher in the early part of the year with 2 readings over 50 cfu/100 mL.

Clear Lake – Kawartha Park Cottager's Association						
2021 *E. coli* Lake Water Testing – *E. coli* cfu/100 mL						
Site	July 4	July 19	July 30	August 3	August 16	September 8
A	2	12	2	2	0	2
B	2	1	1	1	0	2
C	6	2	0	1	0	0
D	16	1	0	0	0	0
P	0	0	4	1	1	0
W	3	36	7	10	0	8

Counts were generally low at all six Kawartha Park sites.

Appendix E - 2021 *E. coli* Test Results

Clear Lake – Birchcliff Property Owners Association						
2021 *E. coli* Lake Water Testing – *E. coli* cfu/100 mL						
Site	July 9		July 27	August 24	Sept 2	September 8
2	0		0	2	1	2
3	0	No	4	20	0	21
4	0	samples	5	2	23	10
5	1	collected	1	22	4	4
6	2		22	38	1	23
7	0		0	3	2	0
8	12		28	4	1	0
B-B	2		2	2	20	7

Counts were generally low at all eight BPOA sites on Clear Lake.

Katchewanooka Lake – Site 2						
2021 *E. coli* Lake Water Testing – *E. coli* cfu/100 mL						
Site	July 5	July 19	July 26	August 3	August 17	September 7
2	1	7	3	5	39	17

Counts were generally low at this site on Lake Katchewanooka.

Katchewanooka Lake – Site 7						
2021 *E. coli* Lake Water Testing – *E. coli* cfu/100 mL						
Site	July 5	July 19	July 26	August 3	August 17	September 7
7	24	13	0	21	5	2

Counts were generally low at this site on Lake Katchewanooka.

Lovesick Lake – Lovesick Lake Association						
2021 *E. coli* Lake Water Testing – *E. coli* cfu/100 mL						
Site	July 5	July 19	July 28	August 3	August 17	September 7
16	No	1	7	1	0	1
20	samples	4	9	3	5	2
21	collected	3	6	0	1	2

Counts were consistently low at all three sites on Lovesick Lake.

Appendix E - 2021 *E. coli* Test Results

Lower Buckhorn Lake – Lower Buckhorn Lake Owners Association						
2021 *E. coli* Lake Water Testing – *E. coli* cfu/100 mL						
Site	July 5	July 19	July 26	August 4	August 23	September 6
2	14	38	16	6	10	21
5	26	7	26	29	9	0
11	2	8	4	0	0	10
13	7	45	6	2	6	**95** rt 23, 17, 3
20	0	1	0	1	2	0

Counts were generally higher early in the year. One high reading in September was lower on retest ('rt').

Pigeon Lake – Concession 17 Pigeon Lake Cottagers Association						
2021 *E. coli* Lake Water Testing – *E. coli* cfu/100 mL						
Site	July 12					
A	2	No	No	No	No	No
B	0	samples	samples	samples	samples	samples
C	**57**	collected	collected	collected	collected	collected

One high reading occurred at site C in July. Tester was unable to complete the program.

Pigeon Lake – North Pigeon Lake Association						
2021 *E. coli* Lake Water Testing – *E. coli* cfu/100 mL						
Site	July 4	July 19	July 25	August 2	August 17	September 6
5A	3	25	**57**	34	10	3
6	27	19	16	21	10	25
8	1	4	3	1	1	0
13	5	20	5	9	16	25
14	5	4	3	3	0	**114** rt 1

Counts were higher at some sites early in the year due to waterfowl activity. One very high reading in September at site 14 was resolved on retest.

Pigeon Lake – Victoria Place						
2021 *E. coli* Lake Water Testing – *E. coli* cfu/100 mL						
Site	July 5	July 19	July 26	August 3	August 17	September 7
1	5	0	4	0	0	1
2	1	1	0	1	1	0
3	2	1	1	0	0	1
4	4	0	1	2	1	0
5	8	2	8	2	0	0

Counts were low at all five sites on Pigeon Lake tested by Victoria Place.

Appendix E - 2021 *E. coli* Test Results

Sandy Lake – Sandy Lake Cottagers Association						
2021 *E. coli* Lake Water Testing – *E. coli* cfu/100 mL						
Site	July 5	July 18	July 25	August 3	August 17	September 7
1	5	1	0	1	1	0
2	0	0	0	0	0	2
3	1	0	1	0	6	6

All counts at these sites were low, consistent with previous years.

Stony Lake – Association of Stony Lake Cottagers						
2021 *E. coli* Lake Water Testing – *E. coli* cfu/100 mL						
Site	July 7	July 19		August 5		September 7
E	34	4	No	**99**	No	1
F	18	17	samples	0	samples	3
I	28	16	collected	17	collected	12
L	2	1		0		0
P	4	1		0		2
PRV28	8	**82**				17

Counts are low at most sites on Stony Lake. Site I is very close to an area of still water where geese congregate which might explain the occasional high counts such as in August at this site.

Upper Stoney Lake – Upper Stoney Lake Association						
2021 *E. coli* Lake Water Testing – *E. coli* cfu/100 mL						
Site	July 5	July 19	July 27	August 3	August 17	September 7
6	11	22		3	4	1
20	9	3	No	17	2	4
21	3	0	samples	2	0	0
52	16	31	collected	32	16	14
65	0	0		3	1	1
70	0	2		17	2	0
78A	2	1		2	0	1

Upper Stoney Lake counts are typical of many Kawartha lakes with most counts below 20 but with occasional elevated readings.

Appendix F - Phosphorus, Secchi Depth and Calcium 2020 Test Results

Total phosphorus (TP) measurements

In 2020 volunteers tested 20 sites in 11 Kawartha lakes. Results are listed below. A number of TP measurements are in bold type. These were considered outliers and were not used to calculate the TP average.

STN	Site ID	Lake Name	Site Description	Date	TP1 (µg/L)	TP2 (µg/L)	Avg.TP (µg/L)
6902	2	BALSAM LAKE	N Bay Rocky Pt.	25-May-20	3.6	5.8	4.7
6902	5	BALSAM LAKE	NE end-Lightning Pt	23-May-20	11.4	12.2	11.8
6902	5	BALSAM LAKE	NE end-Lightning Pt	18-Jun-20	8.4	9.2	8.8
6902	5	BALSAM LAKE	NE end-Lightning Pt	23-Jul-20	9.8	10.0	9.9
6902	5	BALSAM LAKE	NE end-Lightning Pt	31-Aug-20	7.4	8.4	7.9
6902	5	BALSAM LAKE	NE end-Lightning Pt	14-Sep-20	6.8	6.8	6.8
6902	5	BALSAM LAKE	NE end-Lightning Pt	10-Oct-20	10.4	7.6	9.0
6902	7	BALSAM LAKE	South B-Killarney B	22-May-20	8.2	7.0	7.6
6902	7	BALSAM LAKE	South B-Killarney B	03-Jul-20	**56.8**	10.8	10.8
6902	7	BALSAM LAKE	South B-Killarney B	14-Aug-20	18.6	18.0	18.3
6902	7	BALSAM LAKE	South B-Killarney B	31-Aug-20	16.6	14.4	15.5
6902	7	BALSAM LAKE	South B-Killarney B	12-Sep-20	9.4	8.2	8.8
6902	7	BALSAM LAKE	South B-Killarney B	31-Oct-20	19.2	15.8	17.5
363	1	BIG CEDAR LAKE	Mid Lake, deep spot	06-Oct-20	7.2	7.0	7.1
7131	9	BUCKHORN LAKE (U)	Young's Cove, Deep Spot	11-Oct-20	12.2	13.0	12.6
7131	10	BUCKHORN LAKE (U)	NE of Fox Is	17-Oct-20	9.8	16.8	13.3
6955	1	CLEAR LAKE	Mackenzie Bay	09-Jul-20	11.4	12.6	12.0
6955	1	CLEAR LAKE	Mackenzie Bay	12-Aug-20	18.8	20.4	19.6
6955	1	CLEAR LAKE	Mackenzie Bay	24-Aug-20	15.4	15.8	15.6
6955	1	CLEAR LAKE	Mackenzie Bay	08-Sep-20	21.0	16.4	18.7
6955	2	CLEAR LAKE	Main Basin-deep spot	08-Oct-20	15.2	14.6	14.9
6955	3	CLEAR LAKE	Fiddlers Bay	08-Oct-20	16.2	15.6	15.9
7076	2	KATCHEWANOOKA LAKE	Young Pt near locks	10-Oct-20	15.8	15.2	15.5
6990	4	LOWER BUCKHORN LAKE	Deer Bay W-Buoy C267	22-May-20	14.2	11.4	12.8
6990	4	LOWER BUCKHORN LAKE	Deer Bay W-Buoy C267	19-Jun-20	16.8	16.2	16.5
6990	4	LOWER BUCKHORN LAKE	Deer Bay W-Buoy C267	08-Jul-20	22.4	21.8	22.1
6990	4	LOWER BUCKHORN LAKE	Deer Bay W-Buoy C267	08-Aug-20	27.2	28.4	27.8
6990	4	LOWER BUCKHORN LAKE	Deer Bay W-Buoy C267	14-Sep-20	19.4	17.8	18.6
6990	4	LOWER BUCKHORN LAKE	Deer Bay W-Buoy C267	09-Oct-20	11.2	11.6	11.4
6919	15	PIGEON LAKE	C340-DeadHorseSho	03-Oct-20	16.0	**39.4**	16.0
7241	2	SANDY LAKE	Mid Lake, deep spot	21-Jun-20	5.2	5.4	5.3
7241	2	SANDY LAKE	Mid Lake, deep spot	17-Jul-20	5.2	5.4	5.3
7241	2	SANDY LAKE	Mid Lake, deep spot	19-Aug-20	5.2	5.4	5.3
7241	2	SANDY LAKE	Mid Lake, deep spot	06-Sep-20	6.2	6.8	6.5
7133	6	STONY LAKE	Gilchrist Bay	23-Jun-20	**21.4**	15.8	15.8
7133	6	STONY LAKE	Gilchrist Bay	23-Jul-20	16.8	15.6	16.2
7133	6	STONY LAKE	Gilchrist Bay	21-Sep-20	**87.2**	22.4	22.8

Appendix F - Phosphorus, Secchi Depth and Calcium 2020 Test Results

2020 Secchi depth and calcium measurements

Named after its inventor, Angelo Secchi, a Secchi disk is a device for measuring water clarity. It is a weighted disc 20cm in diameter with alternate black and white quadrants. When lowered into a lake, the depth at which the disc can no longer be seen (the black and white quadrants cannot be distinguished) is called the Secchi depth. The deeper the Secchi depth, the clearer the water. Basic water clarity can be affected by the amount of sediments or dissolved organic matter (DOM) that the water contains. Seasonal variation of water clarity is usually related to the amount of algae it contains resulting in spring and fall Secchi depths being greater than mid-summer values. The Lake Partner Program (LPP) asks volunteers to measure the Secchi depth every two weeks between early May to early October. Since 2018, LPP have averaged the Secchi depths and only provide the seasonal average which is presented here. (A '–' indicates no average given.)

Calcium is a nutrient that is required by all living organisms. Aquatic species from zooplankton to crayfish depend on extracting calcium from lake water in order to grow. Levels of calcium below 2.5 mg/L can threaten the survival of many aquatic species. Calcium in lake water is derived from mineral weathering of rocks and atmospheric deposition of calcium-rich dust. Many Ontario lakes on the Precambrian Shield have been found to have very low calcium levels believed to be due to the low rate of weathering of hard, low calcium content rocks and the removal of calcium from the watershed by forest harvesting. As a result, since 2008 the LPP has been measuring the calcium concentration of some lake water samples for all lakes tested for Total Phosphorus. The average calcium measurement for each site in 2020 is provided in the table below. As shown in the table, the Kawartha Lakes do not have a calcium deficiency. The limestone bedrock and calcareous soils to the south of the lakes provide more than enough calcium to sustain the aquatic life in our lakes.

STN	Site ID	Lake	Site Description	Date	Secchi Depth (m)	Calcium (mg/L)
6902	2	BALSAM LAKE	N Bay Rocky Pt.	2020 Avg.	-	21.5
6902	5	BALSAM LAKE	NE end-Lightning Pt	2020 Avg.	4.5	10.1
6902	7	BALSAM LAKE	South B-Killarney B	2020 Avg.	4.2	19.9
363	1	BIG CEDAR LAKE	Mid Lake, deep spot	2020 Avg.	5.6	28.4
7131	9	BUCKHORN LAKE (U)	Young's Cove, deep spot	2020 Avg.	-	29.5
7131	10	BUCKHORN LAKE (U)	NE of Fox Is	2020 Avg.	3.6	30.2
6955	1	CLEAR LAKE	Mackenzie Bay	2020 Avg.	3.6	31.3
6955	2	CLEAR LAKE	Main Basin-deep spot	2020 Avg.	4.0	27.9
6955	3	CLEAR LAKE	Fiddlers Bay	2020 Avg.	3.5	28.0
7075	2	JULIAN LAKE	Mid Lake, deep spot	2020 Avg.	5.6	-
7076	2	KATCHEWANOOKA	Young Pt near locks	2020 Avg.	5.7	27.9
6990	4	LOWER BUCKHORN	Deer Bay W-Buoy C267	2020 Avg.	3.9	31.9
6990	7	LOWER BUCKHORN	Lower Deer Bay, Mid-deep	2020 Avg.	2.0	-
6990	8	LOWER BUCKHORN	Main basin, deep spot	2020 Avg.	2.3	-
6919	15	PIGEON LAKE	C340-Dead Horse Shoal	2020 Avg.	3.1	26.9
7241	2	SANDY LAKE	Main basin, deep spot	2020 Avg.	4.6	41.6
7133	6	STONY LAKE	Gilchrist Bay	2020 Avg.	3.0	30.4
5178	1	UPPER STONEY LAKE	Quarry Bay	2020 Avg.	6.2	25.4
5178	3	UPPER STONEY LAKE	Young Bay	2020 Avg.	7.2	26.7
5178	4	UPPER STONEY LAKE	S Bay, deep spot	2020 Avg.	-	25.7
5178	5	UPPER STONEY LAKE	Crowes Landing	2020 Avg.	6.9	23.9
5178	6	UPPER STONEY LAKE	Mid Lake, deep spot	2020 Avg.	6.9	24.5
6963	1	WHITE LAKE	S end, deep spot	2020 Avg.	-	32.5

Visit the KLSA Website

Learn more about KLSA on the website: **klsa.wordpress.com**

- KLSA Annual Lake Water Quality Reports from 2001 to 2021
- KLSA Aquatic Plants Guide (2009), Milfoil Weevil Booklet (2011) and Algae Guide (2012)
- Research Studies by University and College faculty and students
- Lake Water *E. coli* sampling video and instructions for volunteer water testers
- Announcements of upcoming meetings and events: Watch for a series of Dockside Chats during 2022

Also on the website:

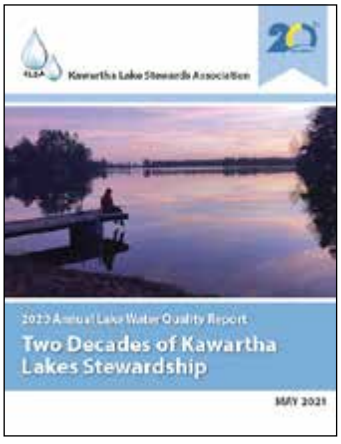
- *Climate Change and the Kawarthas: Context, Issues and Response*
  W. A. Napier, Kawartha Lake Stewards Association, 2020
- *Status of Dissolved Oxygen Levels in Pigeon, Lovesick and Stony Lakes*
  KLSA and Fleming College, 2018
- *Assessment of Algae and Elemental Changes in Three Kawartha Lakes: A Paleolimnological Approach*
  KLSA and Queen's University, 2018
- *Phosphorus and the Kawartha Lakes*
  Michael White, 2006
- *GIS Mapping for the Kawartha Watershed*
  Base, Flow Rates, Land Use, Geology and more maps

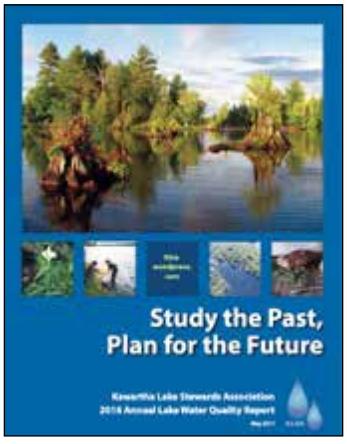
KLSA is also on Facebook at:

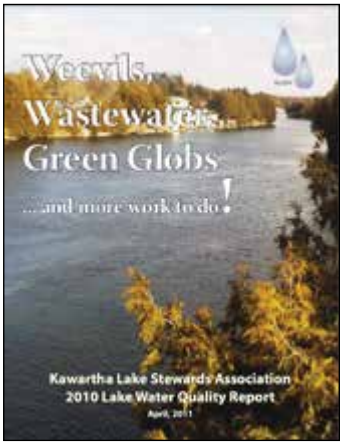
https://www.facebook.com/Kawartha-Lake-Stewards-Association-112540898784824/

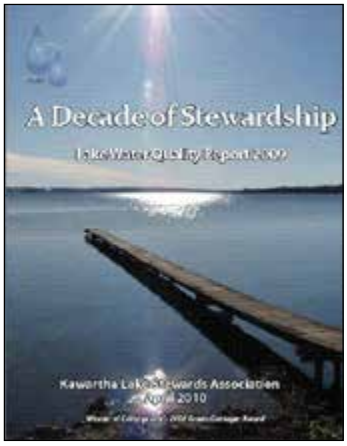
Watch for posts about water quality in the Kawarthas and upcoming KLSA events. Like and Share our posts.

Become a KLSA volunteer – contact klsa@klsa.info









Notice of KLSA Annual Spring Meeting

Kawartha Lake Stewards Association
264 Bass Lake Road Trent Lakes Ontario K0M 1A0
klsa@klsa.info

You're Invited to the Kawartha Lake Stewards Association

2022 Annual Spring Meeting!!

When: Saturday, **May 14th**, from 10:00 – 11:30am

Please join us for our virtual Kawartha Lake Stewards Association Spring Meeting 2022!! This is a chance to learn and connect with others who share a keen interest in keeping our Kawartha Lakes healthy.

Presentation

Tanner Liang, Water Quality Specialist from Kawartha Conservation Authority, and **Erin Smith**, PhD candidate in the Kirkwood Lab at Ontario Tech University, will discuss doing and using community science in the Kawartha Lakes, and the critical role community science plays in environmental science.

There will be lots of time after their brief presentations for questions and to discuss community science with audience members.

Our Spring Meeting is also an opportunity for you to:

- Meet our board of directors,
- Learn about the many projects KLSA is undertaking this summer,
- Find out where you can pick up our ***"2022 Annual Lake Water Quality Report: Lake Stewardship in Action."***

Please Register

Simply click the Evenbrite link below to register.

Registration

Or email klsa@klsa.info for the meeting link.

As always, we welcome donations to support the work of the KLSA. For more information see our website: **https://klsa.wordpress.com/** or send us an e-mail at **klsa@klsa.info**

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